SCIENTIFIC AMERICAN

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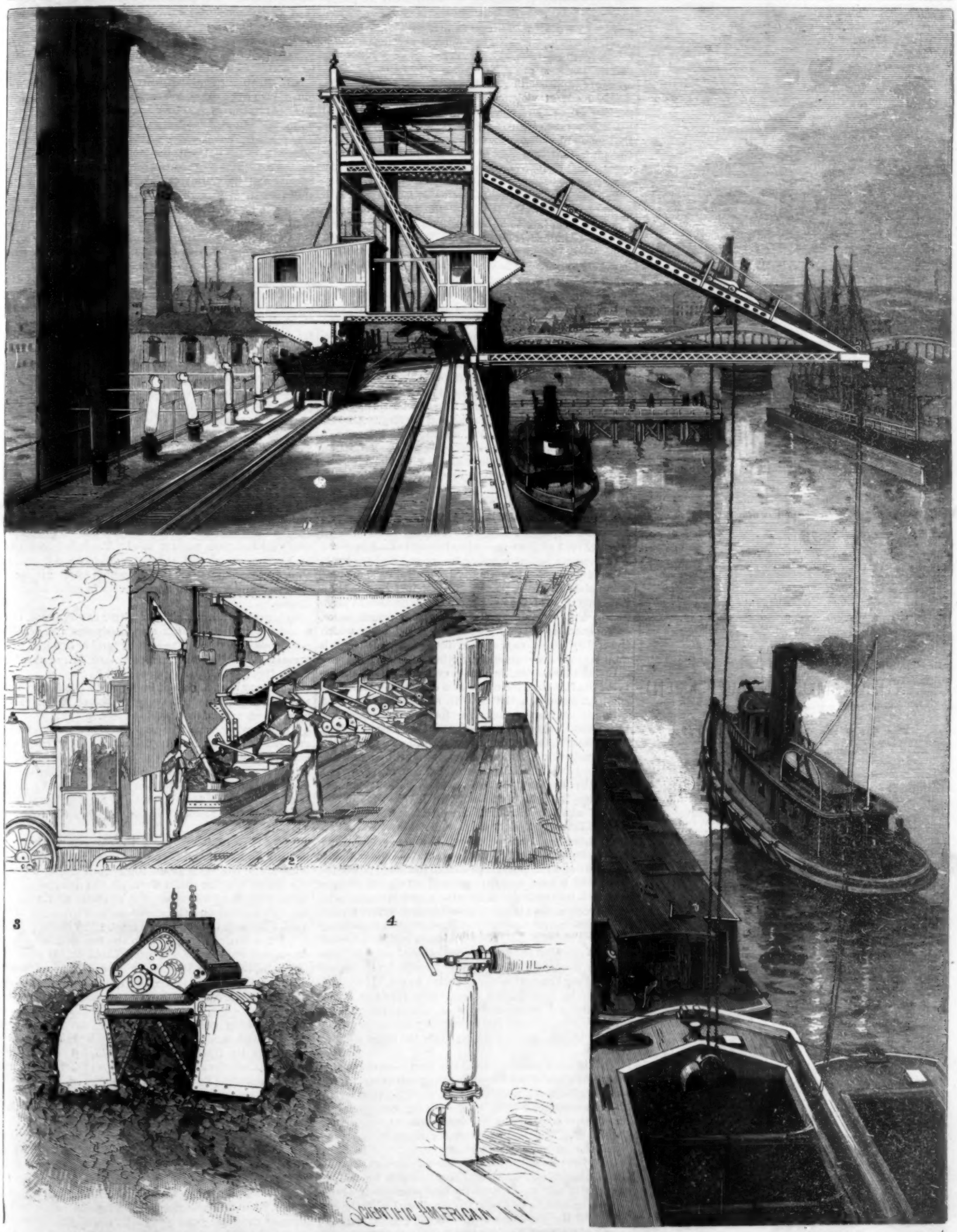

THE COAL HOISTING AND DISTRIBUTING PLANT OF THE MANHATTAN ELEVATED RAILROAD, OF NEW YORK CITY.—[See page 339.]

Scientific American.

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NEW YORK, SATURDAY, JUNE 9, 1894.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 962.

For the Week Ending June 9, 1894.

Price 10 cents. For sale by all newsdealers.

THE COAL STRIKE AND ITS LESSONS.

Some years ago, when natural gas was poured out of numberless wells in such quantities that manufacturers used it with reckless prodigality, a hope was entertained that although the supply might cease the lessons learned in its consumption would not be lost. These lessons were not of a very advanced kind; they simply went to show that gaseous fuel was superior to solid, that it was more manageable, and gave better products, but no lesson of economy of fuel was taught. Manufacturers went on in their usual way without a thought for the future.

The last six weeks have been occupied with occurrences which, grave in the social aspect, have brought the fuel question prominently forward in all its crudities. A strike among coal miners in fourteen States and two Territories has been in progress. The central Western region, included in a general way in the quadrangle defined by Chicago, Birmingham, Pittsburg and St. Louis, is the region most affected. The coal on hand approaching exhaustion, 175,000 men on strike, deeds of violence of frequent occurrence, the poor in cities paying three and four times the usual price for a bucket of coal, were features of the strike that made its seriousness evident. Large numbers of the miners are foreigners and of the most excitable nature, and liable to be carried almost any distance by their feelings.

The cause of the strike is one which brings into strong perspective the fuel question. The miners desire a uniform rate to be established to be paid them for coal as mined. This rate is 75 cents a ton. In some places the miners have received but 42 cents a ton in others 50 cents. Their request seems far from exorbitant. It is clear that the price asked by them is but little for the amount of combustible matter represented by the long ton of coal. So cheap a rate of extraction would imply a very good condition of things for the consumer. But it is not altogether so.

When the miner is paid for the coal which he has cut from the breast of his working, the smallest part of the cost of the coal is provided for. The coal has to go through preparation, more or less expensive, before delivery to the consumer, and it has to be transported from the mines to the furnace and factory. All this adds greatly to its cost. An addition of twenty-five cents to the ton would mean far more at the mine than it would two hundred miles distant. To the miner it means an increase of wages of fifty per cent; to the distant consumer it would mean an increase in price of ten per cent or less.

The improved regenerative and recuperative furnaces of the present day have effected economies of fifty per cent or more in coal consumption. Improved high pressure boilers working compound and triple expansion engines have brought about just as great economies in steam power. Electricity, by enabling the generation of energy to be concentrated in large plants, and to be delivered efficiently in small units, has opened up further possibilities in economy which the trolley street car system illustrates, for there is an unknown development awaiting us in the future.

But the coal strike, bringing out with its other features the fact that the extraction of coal represents so small an amount, and that with superadded transportation it reaches the consumer for so low a price, tells or implies a story of extravagance of coal consumption. With more rational methods of burning it, with more advanced engines for its utilization, with boilers working up to 200 pounds pressure instead of, perhaps, a tenth that amount, the fuel question could be made a much less important one, not only in question of cost but of absolute physical magnitude. For now the trouble is to supply tons enough of coal to keep wasteful furnaces and antiquated boilers and engines in operation, and to supply with fuel small isolated plants using six or eight pounds of coal to the horse power per hour. In a more enlightened and advanced state of society it is to be hoped that better social laws and principles may make strikes impossible and without cause or reason for existence. But outside of the social aspect, in the improvement of processes and in the consequent reduction of the great quantity of coal required lies one possibility of preventing these occurrences and of entitling the coal miner to better wages. If a manufacturer by substituting regenerative furnaces for his old fashioned reverberatories at one operation saves half his coal, he may feel able to pay a price for it that will justify the mine owner in paying the miner a higher rate.

It is in such possibilities as the above—perhaps they are hardly probabilities—that the scientists and inventors, the Siemens and the Bessemers, appear as the world's benefactors. It is in carrying out their processes that some of the highest wages are received by workmen. The Siemens furnace reduced coal consumption to one-half its former amount; the Bessemer converter, taking its fuel from the carbon and silicon of iron, almost abolished coal consumption for the production of soft steel. In advanced processes is always sooner or later to be found the amelioration of the condition of the workman as well as the general improvement of the condition of mankind. The present waste of coal is largely responsible for the low wages of the miners and for the consequent strikes and disturbances.

Cassava Meal and Tapioca.

Next to rice and sago, there are but few food products of a similar character that have such an extensive use as tapioca. And notwithstanding the enormous quantities that are produced, and the cheap rate at which it is sold in the English market, but little is generally known as to its origin and preparation.

Two distinct plants, though closely botanically allied, furnish tapioca; they are *Manihot utilissima, Pohl.*, known as bitter cassava, and *Manihot aipi, Pohl.*, the sweet cassava. The plants are natives of Brazil, where they are extensively cultivated, the bitter cassava especially, for the sake of the starch which is contained in the fleshy tuberous root, and which forms commercial tapioca. It is also largely grown in west tropical Africa, as well as in the Straits Settlements. It is a half shrubby perennial, with large leaves deeply divided into from three to seven segments. The tuberous root often grows to a very large size, weighing many pounds, and containing a poisonous milky juice. The plant is known under a great number of varieties, differing in the color of the stems and the division of the leaves. The roots of the bitter kind are said not to become soft by boiling or roasting, while those of the sweet cassava, though very tough in the center, become soft by the application of heat; so that after being roasted or boiled, they are eaten in a similar manner to potatoes.

Besides tapioca, the cassava root furnishes several other valuable food products, as cassava meal and cassareep. In one of the monthly numbers of the *Bulletin* of the Botanical Department of Jamaica these products and their uses are thus referred to. Cassava meal is prepared from both the sweet and bitter sorts, the root is grated, by which the cells containing the juice and starch grains are broken up, the grated material is placed under pressure, sometimes with water pouring through it. The pressure squeezes out all the juice, while a certain portion of the starch grains passes over with the liquor. The substance left under pressure consists chiefly of the cell walls broken up, but also of some starch grains. This is cassava meal, which is dried on hot plates and made into cassava cakes. The liquor which passes away under pressure being the pure juice only, or the juice mixed with water, which is allowed to stand for some time, when the starch settles to the bottom, and the liquor is poured off. The starch grains, as seen under a microscope, are mullar shaped. This is cassava starch proper, as distinguished from cassava meal. Tapioca is prepared by heating moistened cassava starch on hot plates. This process alters the grains, which swell up, many bursting, and thus they agglomerate in small irregular masses.

Cassareep is the juice of the bitter cassava root, concentrated by heat, which also dissipates the volatile poisonous principle. The same is further flavored with aromatics. Boiled with peppers, and fish or meat, it forms the West Indian "pepper pot."

Cassareep is an article of import into England. It is a thick, black, treacly-looking substance, and forms a component part of most table sauces.

The following details for preparing cassareep, tapioca, and cassava cakes may be found useful: "Grate the cassava, and squeeze out the juice, which is to be put aside for about three days; add one part of fine salt to every twelve quarts, and then boil down, until it becomes like sirup. If it is intended for long keeping, it must be boiled thick. Put aside in jars till required for bottling."

To prepare tapioca, "grate the cassava, wash it, by putting in a cloth, and pouring clean water on it till settled, and the water at the top is quite clear. Decant the water, leaving the starch at the bottom; wash again with clean water, allow it to settle, and pour off the water. Take up the starch in lumps and put it to quail a little in the sun; then mash it up fine and sieve it. Put a large baking iron on the fire, and bake it in cakes, not too thick. The iron should not be too hot, as the cakes must not be baked brown. Then dry well in the sun, and beat in a mortar, coarse or fine, as required. If sieved, it will give two qualities, fine and coarse."

For making cassava cakes, the cassava should be grated, and well squeezed, but not washed. After squeezing, let the lumps dry very slightly in the sun. Beat on a mortar and sieve. Bake on the iron, thin or thick, according as the cakes are required.

A Macadamized Road through Swampy Land.

A Telford road recently built in Medford, Mass., by Street Commissioner John P. Prichard was constructed through low wet land, which had to be drained by a trench 4 feet deep, in which was a 6 inch pipe with open joints. The trench was then filled with stone up to the subgrade of the avenue, which was well wet and rolled. On this was the Telford foundation, 9 inches deep at the center and gradually decreasing in thickness to 5 inches at the curb line. This foundation was

wedged and knapped, and then covered with 4 inches of 2½ inch stone unrolled, which was covered in turn by 3 inches of 2 inch stone, spread with a shovel from a cart, wet and rolled. The surface was next filled with enough half inch stone to fill out all the inequalities, more sprinkling was done and the surface again rolled to form a firm bed for a 2 inch course of 1 inch stone, well wet and rolled. This street, the *Engineering News* says, cost about $3 a linear foot, including the expense of grading, trenching, pipe laying, catch basins, and other incidentals.

The Periodical Cicada, *alias* Seventeen-Year Locust.

BY C. V. RILEY.

Few insects are more characteristically American than this, and few have been more written about or have attracted more popular attention. We become accustomed to the recurring seasons, and periodically recurring phenomena attract attention usually in proportion to the length of time elapsing between their recurrence. This in a measure explains the interest attaching to our periodical Cicada, for its term of life is exceptionally long and quite unique, nothing else of the kind being known among insects in any other part of the world. Most insects require but one year for their full life cycle, and few exceed for this purpose a period of three years. We are justified in indulging a little sentiment in connection with the recurring broods of this insect, since they enable us to go back in thought for centuries in the past and picture the woods in some particular locality, and in some particular year, resounding with its singular song. Thus Brood XII., which is now with us, has its largest distribution in New York and New Jersey, but reaches down to the national capital, and the ancestors of these very insects, six generations back, commemorated in their noisy way the founding of Washington in 1792, while the preceding generation, seventeen years before, made the woods vociferous during the battle of Bunker Hill.

SEVENTEEN-YEAR AND THIRTEEN-YEAR BROODS.

There are some twenty distinct broods pretty well established, each appearing at stated periods in some part or other of the eastern United States, and it often happens, as in the present year, that two of them appear simultaneously, but in different sections. There is, as a consequence, scarcely a year when in some part of the country some brood may not be heralded, and several may and do occur in the selfsame region at different periods. This fact gives rise to the idea that there are broods of shorter period, or say of seven or nine years. In reality, however, there are but two classes of broods, namely, the seventeen-year and the thirteen-year broods.

There are no specific differences between these broods, and so far as the insects themselves are concerned there is nothing to indicate whether they belong to the one or the other. Yet they must be considered as quite distinct races of one species, since they do not intermingle and have, in fact, an essentially different geographical range. The seventeen-year or *septendecim* race occupies the northernmost portion of the range of the species, extending farthest south along the Alleghany Mountains. The *tredecim* or thirteen year race occupies the southern portion of the range of the species. The first named is substantially confined to the transition zone, biologically speaking, extending rarely into the boreal, while the *tredecim* race is absolutely confined to the austro-riparian region, as defined by Dr. C. Hart Merriam.

THE BROODS OF THE PRESENT YEAR.

As shown by a circular issued from the Department of Agriculture, there are now occurring two rather extensive broods, one of each of the races. Below * are given the localities in which each of these broods may be expected, and I shall be glad to have any readers of the SCIENTIFIC AMERICAN corroborate or correct, from their own observations, any of the data thus given. I would especially like to have evidence, confirmatory or otherwise, in all cases where an interrogation point has been used.

TWO DISTINCT FORMS.

With both these races there are two distinct forms, the typical or larger form, originally characterized by Linnaeus as *Cicada septendecim*, measuring some three inches in wing expanse and about an inch and a half from the head to the tip of the closed wings. The inferior portion of the abdomen is more or less suffused with reddish-brown and the borders of the segments dorsally are marked with the same color. There is a smaller form, however, appearing somewhat later in the season and more completely black, which has been described as *Cicada cassinii* Fisher. Besides the differences in size and color, there are also some slight differences of structure, but the two forms intergrade, and the species should be classified as *Cicada septendecim* Linnaeus, race *tredecim* Riley, dimorphic variety *cassinii* Fisher. The long underground life of both the 13-year and 17-year races has been thoroughly established on chronological and historical data covering nearly two centuries. There is, however, chronic skepticism as to the facts, as they are so exceptional, and this is especially true among Europeans; whence the desirability of experimental proof. This I have obtained since 1868 by watching from year to year larvæ hatched from eggs placed under specially marked trees, and in the case of two distinct and different broods.

FOOD OF THE LARVA.

Many persons have insisted, and especially the late Dr. G. B. Smith, of Baltimore, that the larva during its underground life nourishes upon the moisture of the earth and takes no other food. He believed that this moisture was absorbed through capillary hairs at the tip of the proboscis. This is, of course, an entire misapprehension of the facts. These hairs in reality arise from the sheaths of the promuscis and have no connection with the true sucking mouth parts. There is, however, a good deal of evidence to indicate that, especially in early life, when the body covering is delicate, the young Cicada larva may, when necessary, nourish from the moisture of the soil, where this soil contains, as it almost always does, nutrient qualities. The nourishment in such case would be through the general surface of the body or by what might be called environmental assimilation. But while there is no special reason for denying the possibility of this mode of nourishment, it will always be difficult to prove, and the one thing that has been proved and which I have been able thoroughly to confirm is that, as in the case of all other sucking insects, the Cicada larva pierces the roots of plants and derives nourishment therefrom. Careful observation very soon determined this fact, and I have often seen even very young larvæ attached to fine roots, while the places where the roots have been punctured by them are also easily detected.

DEPTH OF THE LARVAL BURROW.

The larva rarely penetrates more than two feet below the surface of the soil, though exceptionally it has been found at much greater depths, there being authoritative records of its having come up through the bottoms of cellars and of its being found at depths of 10 to 12 feet.

METHOD OF BURROWING.

In burrowing the larva scratches away the walls of its cell with the claws of the femora and tibiae, very much as we would do with our hands. The loosened earth is pressed against the sides and ends of the cell, chiefly by the hind and middle legs. When burrowing downward the soil is first gathered into a little pellet and placed deftly on the front of the head, when the larva turns round with its little load and presses it against the upper portion of its burrow.

GALLERIES MADE BY THE PUPA.

In years of exit the pupa is found near the surface of the ground or on it, hiding under stones and logs. There is great uniformity in the issuing of the pupæ, which takes place in the latitude of Washington from the middle to the end of May, but earlier further south and later in its northernmost range. They issue in the same locality, after their long underground life, almost to a day. Frequently, and especially in low soil subject to overflow, or where the soil is particularly wet or covered with masses of wet leaves, the pupa extends the burrow in the shape of a tube from 4 to 6 inches above ground, this tube looking like a diminutive crawfish tube. The purpose of this extension of the tube is easily understood in such situations, but strangely enough we also find the same sort of funnel or tube thrown up on high ground; and the only explanation I can offer for this fact is that on high ground the tubes are thrown up by larvæ hatched from eggs laid by females which had themselves been reared on low ground, and which, as pupæ, had built such funnels themselves. The tubes are generally closed at the top, with an orifice at the surface of the ground, and the pupa awaits its approaching transformation in the top of the funnel, secure against heavy rains, and finally issues from the aperture above mentioned.

FINAL TRANSFORMATION.

It is most interesting to observe the unanimity with which all those pupæ which rise within a certain radius of a given tree crawl in a bee line for the trunk of that tree; and to see these pupæ, in such vast numbers that one cannot step on the ground without crushing several, swarming out of their subterranean holes, scrambling over the ground, all converging to one central point and then clambering up the trunk of the tree and diverging on to its branches, is an experience not readily forgotten and affording food for speculation on the nature of instinct. The phenomenon is most satisfactorily witnessed where there is a solitary or isolated tree. The pupæ begin to rise as soon as the sun is behind the horizon, and the majority of them have risen by about nine o'clock. They prefer to fasten in a horizontal position for the exclusion of the perfect insect or imago, though they transform in all positions. In about an hour after rising the skin splits down the middle of the thorax and the forming Cicada begins to issue. Its colors are first creamy white, with the exception of the red eyes and two strongly contrasting black patches on the prothorax, with certain other minor black marks upon the legs and an orange tinge at the base of the wings. There is a point when the emerging imago hangs by the tip of the abdomen, being held within the cast off exuvium in which position it remains for from ten to thirty minutes or more. During this period the wing pads separate and the front pair stretch at right angles from the body, when they gradually swell, and during all this time the legs are becoming firmer and assuming the ultimate position. Suddenly the insect bends upward with a good deal of effort, and clinging with its legs to the first object reached, whether leaf, twig or its own shell, withdraws entirely from the exuvium, and hangs for the first time with its head up. Now the wings perceptibly swell and expand, until they are fully stretched and hang flatly over the back, being transparent, with beautiful white veining. As they dry they assume the roof position, and during the night the natural colors of the species are gradually assumed. There are few more beautiful sights than to see these fresh forming Cicadas in their different positions, clinging and clustering in great numbers to the outside lower leaves and branches of a large tree. In the moonlight such a tree looks for all the world as though it were covered with beautiful white blossoms in various stages of expansion.

(To be continued.)

* BROOD XVIII.—*Tredecim*—(1881, 1894).

This is the largest thirteen-year brood and one of the best known of all recorded broods.

Alabama.—Blount County and adjacent districts; counties of Dallas, Perry, Lowndes, Montgomery, Russell; also reported from Mobile County.

Arkansas.—Northern and northwestern counties watered by White River and its tributaries; counties of Prairie, Pulaski, Conway and Garland in the central portion, and Sebastian County on the western line of the State.

Georgia.—Cherokee, Campbell and Walker Counties.

Illinois.—Most counties south of Adams County in the west and Jasper County in the east; especially abundant along the Mississippi and Ohio, but apparently not present in the counties adjacent to Wabash River. The following is a list of the counties reported to have been occupied by the Cicada in 1868 or 1881: Adams, Bond, Clinton, Champaign, Coles, Cumberland, Clay, Edwards (?), Franklin, Green, Hardin, Hamilton, Johnson, Jasper, Jersey, Jefferson, Lawrence, McLean, Macon, Madison, Marion, Massac, Monroe, Morgan, Pike, Perry, Piatt, Richland, Randolph, St. Clair, Saline, Sangamon, Union, Washington, Wayne and Williamson (?)

Indian Territory.—Near Muscogee P. O. (?)

Kentucky.—McCracken County and adjoining counties in the northwest corner of the State.

Louisiana.—Morehouse, Caddo, Claiborne, Washington and adjoining parishes.

Mississippi.—Madison County.

Missouri.—More or less throughout the whole State, with the exception of the northwest corner, bounded on the east by the Grand River, and on the south by the Missouri River. In the year 1881 or 1868 or at previous intervals of thirteen years the Cicadas have been reported from the following counties: Andrain, Bollinger, Benton, Clarke, Charlton, Callaway, Cooper, Cole, Franklin, Gasconade, Iron, Jefferson, Knox, Lewis, Marion, Macon, Morgan, Moniteau, Pike, Phelps, Pulaski, Polk, Pettis, Schuyler, Saint Charles, Saint Louis, Saint Francois, Saint Clair, Warren, Washington.

North Carolina.—Counties of Mecklenburg and Iredell, extending north and west into Wilkes and Caldwell Counties.

South Carolina.—County of Chester, extending westward to the Georgia line and northward to the North Carolina line; also counties of Anderson, Oconee and Pickens.

Texas.—The reported occurrence of this brood in the Rio Grande Valley south of El Paso is extremely doubtful.

Virginia.—Prince George County.

BROOD XII.—*Septendecim*—(1877, 1894).

This is also a well recorded brood of large extent, occurring chiefly along the eastern flank of the Alleghany Mountains. The isolated western localities are in need of confirmation.

Connecticut.—Near Meriden and New Haven, New Haven County.

District of Columbia.—This includes the adjacent portions of Virginia and Maryland.

Indiana.—Dearborn County (?)

Maryland.—The peninsula between the Potomac River and Chesapeake Bay, from Anne Arundel County to the northern part of St. Mary's County.

Michigan.—At Kalamazoo (?)

New Jersey.—The whole State, but more especially in the northeastern counties of Hudson, Bergen, Essex and Middlesex.

New York.—Within the city of New York (at least in former times, but in 1877 apparently exterminated by the sparrow); on Staten Island, western Long Island, along both sides of the Hudson River as far north as Troy.

North Carolina.—Rockingham, Stokes, Guilford, Rowan, Surry and adjoining counties.

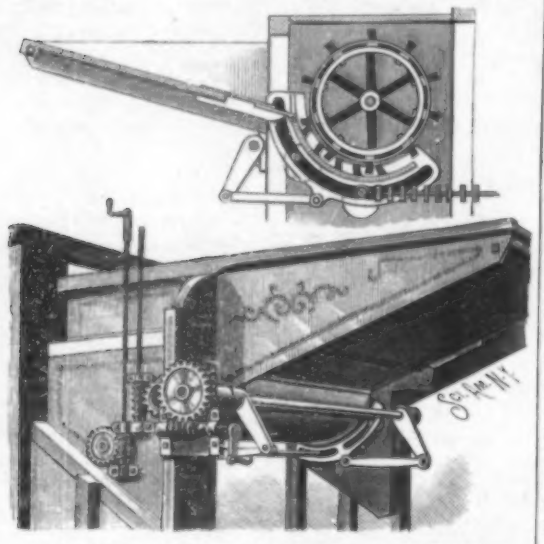
Virginia.—From Fairfax County and southern portion of Loudoun County south to the North Carolina line.

The Electric Furnace and Artificial Diamonds.

At a recent conversazione of the Royal Society, an exhibit which attracted much attention was M. Moissan's electric furnace, and specimens of chemical elements obtained by means of it: vanadium, chromium, molybdenum, tungsten, uranium. The furnace consists of a parallelopiped of limestone having a cavity of similar shape cut in it. This cavity holds a small crucible, composed of a mixture of carbon and magnesia. The electrodes are made of hard carbon, and pass through holes cut on either side of the furnace, meeting within the cavity. For the purpose of certain experiments a carbon tube was fixed in the furnace at right angles to the electrodes, and so arranged as to be 10 mm. below the arc, and about the same distance from the bottom of the cavity. This tube contains the material to be heated, and by inclining it at an angle of about 30° the furnace may be made to work continuously, the material being introduced at one end of the tube and drawn off at the other. A temperature of about 3,500° C. is produced. The metals are reduced by heating a mixture of their oxides with finely divided carbon, and for this purpose a current of about 600 amperes and 60 volts is employed. M. Moissan has not only succeeded in reducing the most refractory metals, but has fused and volatilized both lime and magnesia. Nearly all the metals, including iron, manganese, and copper, have also been vaporized, while by fusing iron with an excess of carbon, and then quickly cooling the vessel containing the solution of carbon in molten iron by suddenly plunging it into cold water, or better in a bath of molten lead, he has been successful in producing small, colorless crystals of carbon, identical in their properties with natural diamonds.

AN IMPROVED THRASHING MACHINE FEED.

The regulation of the draught in hand or self-feeding thrashing machines is readily effected by means of the improvement shown in the accompanying illustration, which provides for the convenient adjustment of the concave to or from thecylinder to suit any kind of grain, the concave and feed board being also so connected that the latter will be adjusted simultaneously with the former. The invention has been patented by Mr. David W. Broatch, of Pepin, Wis. The sides of the concave are formed of movable semi-



BROATCH'S THRASHING MACHINE ATTACHMENT.

circular bearings, each of which consists of a plate with a slide-way on its inner face in which are loosely held the ends of the body portion of the concave, the sides or bearings of the concave not being attached in any way to the sides of the machine. On the central portion of the under edge of each side or bearing is a lug, pivotally connected by links and crank arms with an adjusting shaft journaled in the forward lower portion of the casing, and having at its outer end a gear wheel meshing with a worm on a short shaft turned by a hand crank, whereby the concave may be carried upward or be lowered, moving concentrically with the cylinder and around it.

The feed board section, as shown in the sectional view, has hinged connection with the upper edge of the concave, and when the latter is carried to its upper position the feed board is very nearly horizontal, when the feed will be quite slow, but as the concave is lowered the feed board becomes correspondingly more inclined, providing for a substantially rapid feed. For the adjustment of the concave vertically, and to and from the feed end of the machine, two shafts, one forward of the other, are passed through segmental slots in the under sides of the concave bearings, each shaft having near each end an eccentric, whereby, on turning one of the shafts, the concave will be raised or moved forward, or lowered or withdrawn from the cylinder of the machine. The rotation of each shaft is effected by a worm on the lower end of a vertical rod, engaging a gear wheel on the outer end of the shaft, the rod being turned by a crank within easy reach of the operator. The attachment is readily adjustable to and may be applied to any thrashing machine.

NEW MULTIPOLAR GENERATOR.

There is no better evidence of real merit in a manufactured article than a demand for that article which in times of great financial depression like these compels the building of larger works and a general increase of manufacturing facilities. The Belknap Motor Co., of Portland, Maine, is one of the manufacturing concerns so situated, and notwithstanding the hard times, this company is building a large addition to its factory preparatory to going into the manufacture of large railway generators and motors.

We give an engraving of the recently perfected Belknap Multipolar Generator which that enterprising company has just put on the market. The frame of the machine is composed of several parts, making it convenient to handle. The total weight is quite uniformly divided between the several parts, as shown in the engraving, making a machine which may be conveniently set up in stations not provided with apparatus for handling very heavy weights. The bed is planed to fit iron slides and is very rigidly constructed, so as to withstand the strain brought on it by the weight of the field magnet.

The magnet is formed of two iron castings, both together forming a complete circle, with four inwardly projecting cores to receive the field coils. The magnet is bored and fitted with a pole bushing surrounding the armature, which gives the greatest possible effective polar arc, and prevents the disagreeable humming sometimes observed with toothed armatures under heavy loads, and suppresses the tendency to spark by reason of stray lines of force.

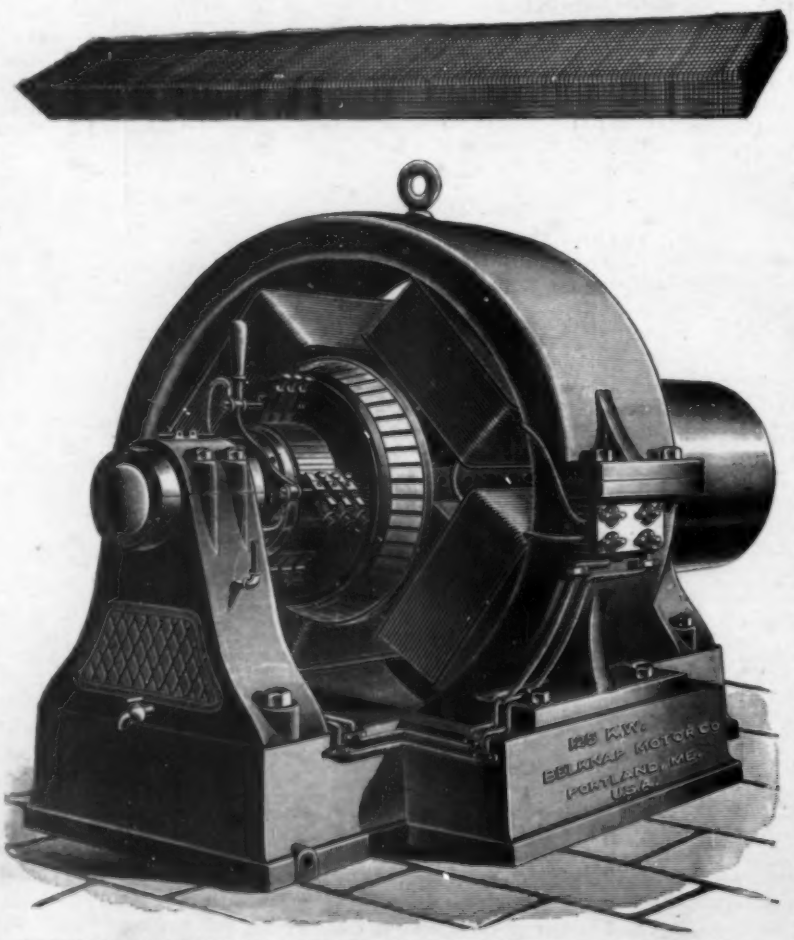
The armature is of the toothed hollow drum type. By a system of end connections, crossing of the conductors at the leads of the armature is avoided, thus reducing the danger of short circuiting and burning out and permitting of conveniently getting at every wire.

The commutator is massive, and the well-known Belknap patent woven wire and graphite brushes are used. The bearings, which are very large, are self-lining and self-oiling. The two terminals are located at opposite sides of the machine, to avoid the danger of a short circuit.

The field cores are compound wound and the magnetic circuit of the machine is carefully designed with reference to the reluctance of cast iron, wrought iron and air, so as to get the very best attainable effect from the materials used.

The new graphite and woven wire brush above mentioned contains all the essential qualities of both copper and carbon, the graphite acting as a lubricant and the copper as a conductor. The brush being flexible, makes a good contact with the commutator. These brushes are largely used on dynamos of other types.

The Belknap Motor Co. has an office at 135 Liberty Street, New York City, one at Philadelphia and one at Boston.



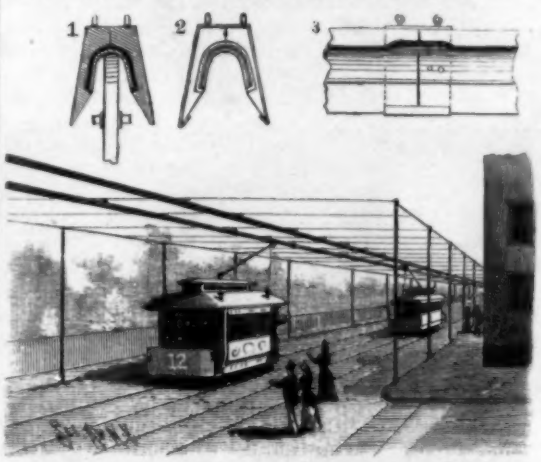
THE BELKNAP MULTIPOLAR GENERATOR—WOVEN WIRE AND GRAPHITE BRUSH.

Building and Loan Associations.

The Hon. Carroll D. Wright, whose continuance at the head of the National Labor Bureau is matter for public congratulation, has made building and loan associations the subject of this year's report. These savings associations are now established in every State in the Union. Pennsylvania comes first, with over one thousand associations; Ohio second, with over seven hundred; and then in close succession follow Illinois, Indiana, New York and Missouri. Even in the South these co-operative organizations have gained more than a foothold in all the States, being relatively stronger there than in New England. This, of course, is not due to the greater strength of the co-operative spirit among the people, but to the fact that in New England the savings banks, which are essentially co-operative, supply the need which has occasioned the rapid spread of building and loan associations in other parts of the country. Of the six thousand associations in the country, less than five hundred are more than fifteen years old. Yet the assets now aggregate $450,000,000, and the commissioner estimates that probably four hundred thousand homes have been built with the aid of these associations. This is a triumph of co-operation comparable with what has been achieved by the famous societies of Great Britain.—*The Outlook.*

AN IMPROVED TROLLEY CONDUCTOR.

With the trolley conductor shown in the illustration, the trolley wheel may be easily and conveniently brought into contact with the conductor when the shifting of the trolley is necessary. The improvement has been patented by Mr. Robert Muir, of No. 13 Stewart Street, Brooklyn, N. Y. Figs. 1 and 2 represent sections transversely through the conductor, and Fig. 3 is a longitudinal section showing how the joints are made. The conductor is shaped substantially as an inverted trough, and is protected by a casing, preferably of wood, made in two sections, engaging one another at the top, and tied together where a joint is made by a shoe, as shown in Figs. 2 and 3. Between the conductor and its casing is a packing of insulating material, and the sections are joined by a plate cross-



MUIR'S OVERHEAD TROLLEY CONDUCTOR.

ing the joints when the ends of the sections are brought nearly end to end. The conductor is supported by transverse wires from posts each side of the track, these wires passing through eyes in the top of the casing. The construction is designed to prevent the trolley wheel from jumping from or leaving the conductor, and facilitate its being replaced in contact therewith when it may have been purposely withdrawn.

Dulcin.

Dulcin, or sucrol, a new sweetening agent, which is said to be from 200 to 250 times as sweet as sugar, was first produced by J. Berlinerblau. Structurally it must be described as para-phenacetol carbamid. It is an aromatic uric acid derivative related to phenacetin. It is a white powder which melts at 173° C. to 174° C., and is soluble in about 800 parts of water at 15° C., fifty parts of boiling water, and twenty-five parts of a cold 90 per cent solution of alcohol. These particulars are taken from a contribution by Professor Kobert, of Dorpat, to the *Centralblatt fur Innere Medicin.** Particulars as to its physiological effects are also given. Dogs seem comparatively sensitive to dulcin, dying with such evidences of blood destruction as icterus, while rabbits appear to be quite impervious to its influence. Professor Kobert relates his own experience with the drug in the case of cats. These animals reveal no evidence of blood destruction, but seem to die with symptoms of cerebral paralysis; this is also the manner of death of frogs subjected to subcutaneous injections of dulcin. These are, of course, the extreme effects of poisonous doses. In the relatively small doses necessary for sweetening the food of diabetic patients and the obese, Professor Kobert considers the agent harmless, and mentions a case in which eight grammes were taken daily for three weeks with impunity. The *Lancet* says it is quite evident, however, from the physiological experiences related that some care is necessary in the use of this article.

A Church-Going Robin.

A few Sundays ago, says the London *Standard*, the family of Mr. W. A. Wykeham Musgrave, entering their pew in Thayme Park Chapel, Oxfordshire, were surprised to see a partially built robin's nest on the book ledge against a prayer book and a hymn book. The family immediately decided to occupy another seat and to leave the little redbreast unmolested in its strange abode. On the following Sunday the nest was completed and contained five eggs, and on the succeeding Sunday the bird sat on the eggs during the whole of the service. It has now been found that the bird has hatched four young ones, and the mother flew in and out of the chapel during the service with food for her young.

*No. 16, 1894.

SOME IMPROVED TOOLS.

It is said a good mechanic can work with poor tools. No doubt he can, but we think he will not, so long as improved tools are obtainable. Of fine tools made by L. S. Starrett, of Athol, Mass., we have selected two

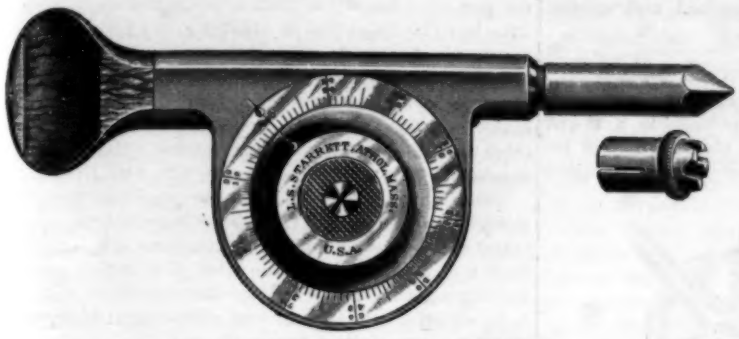


Fig. 1.—STARRETT'S SPEED INDICATOR.

or three for illustration. The speed indicator shown in Fig. 1, although a very simple instrument, embodies several improvements appreciated by mechanics. The worm and worm wheel are inclosed, and the dial which is carried by the worm wheel has graduations showing every revolution. The graduations are provided with two sets of numbers, so that the speed may be read off right or left according to the direction of rotation.

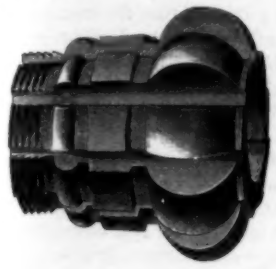


Fig. 2.—FORMED MILLING CUTTERS.

The dial is locked to a revolving stud from which it may be readily released, so that it may be returned to the zero without the necessity of turning the instrument to bring it there. A split cap is provided to adapt the instrument for use on centers or pointed shafts. The instrument has a heat insulating handle, which permits the instrument to be held in the position of use even though it should become warmed by use on high speed shafts. The dial is provided with a rounded stud which permits of counting the revolutions by the sense of touch.

Figs. 2 and 3 illustrate some of the improved milling cutters made by Mr. Starrett. Fig. 2 shows a spiral form of cutter for milling complicated shapes, and Fig. 3 represents a gang of cutters. As will be seen from

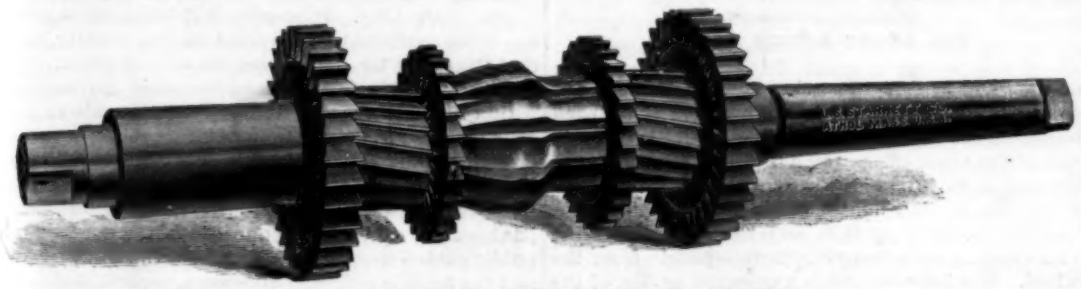


Fig. 3.—STARRETT'S GANGS OF MILLING CUTTERS.

these illustrations, there is practically no limit to the forms to which these cutters may be adapted.

A Sailing Bicycle.

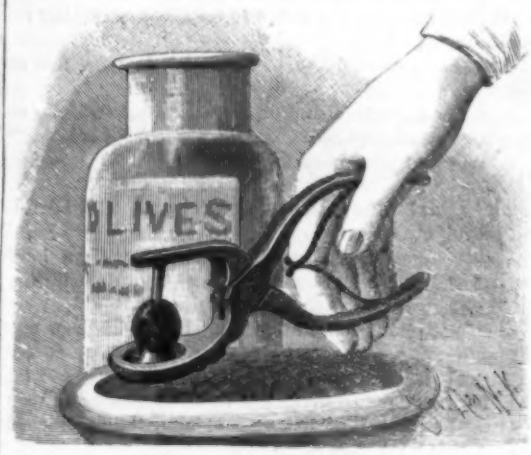
Every cyclist, says the Chicago *Evening Post*, will want to know about the invention of Charles D. White, of San Bernardino, Cal., who has recently invented a way of satisfactorily attaching a mast to the common bicycle. The principal difficulty experienced was in securing the sail firmly to the wheel. After several attempts Mr. White made a head block, in which the end of the mast was placed and secured. This block can be removed very easily by taking off the burrs on two bolts. When the sail is removed the block does not interfere with the use of the machine. The block head is made of Oregon pine, while the two side clamps are of oak half an inch thick. These are securely fastened to the wheel by two iron bolts. Great care should be exercised in placing this particular part of the attachment in position. The head block must not be fastened to the handle bars or tubing, as it will interfere with the guiding of the bicycle. It must be bolted to the joint below the elbow, as this allows the free use of the handles to direct the wheel's course. To those who will doubtless try the invention it may be explained that they should be very careful not to secure the boom to the machine, but fasten a small pulley to the spring under the seat, and allow the cord attached to the boom to run freely through it, as the balance can be kept much better in this manner. Mr. White's sail is attached to a ten foot mast and an eight foot boom, and weighs six pounds and nine ounces. The cost complete is about ten dollars, if the work is performed by the individual himself. Almost any one can make a sail and place it on the wheel. With a few hours' practice a good wheelman, Mr. White says, can easily manipulate it, and enjoy a ride without fatigue. For the benefit of those who will try the labor-saving device, Mr. White gives the following advice on the subject: "After making or buying the sail and placing it in position, keep the same furled until outside of the city, on a quiet and lonely road. Be careful when approaching a horse, as the animal will take fright when a fourth of a mile away if the sail is in position. On arriving at a secluded spot hoist the sail and allow it to swing loosely in the wind. Mount the machine the same as usual, and pedal while the wind is filling the sail, gradually, and the regular rate of speed is being acquired. Then the sail will come under perfect control. The best position is to keep one hand on the handle bars and the other on the boom, should it be close enough to the rider. When the sail swings away from the reach, control it by the cord running through the pulley under the seat. Be sure the cord will slip through the pulley easily, or a sudden squall will unseat you instantly. Keep the feet on the pedals, which should be racing or 'rat traps,' as they will hold the feet in position best. This will assist materially in keeping balance. The coasters can be used, but not so well as the first mentioned. Sailing before the wind you will go just twice as fast as in ordinary bicycle riding, while the greatest velocity is gained while riding at right angle from the wind. With good handling a speed of from twenty to thirty miles per hour can be obtained. Beating against the wind is very hard, as it is almost impossible to tack in narrow roads. No rudder is needed, which brings about a saving in resistance."

The Structure and Chemistry of the Cyanogen Flame.

Professor Smithells, of Leeds, lately read a paper on this subject before the Chemical Society, London. The association of peach blossom and cyanogen as descriptive of the color of the flame is a combination which, once learned, we never forget. The composite character of the flame is especially well seen when the cyanogen is burnt in the tube apparatus devised by Professor Smithells, where the separation of the flame into "cone" and "mantle," each burning some inches from the other, is readily effected. It was demonstrated that the colors of the flames vary according to the proportion of air that is present at the moment of combustion. With a little air the cone burns with its characteristic rosy flush, while the outer flame or mantle is blue, shading off to crimson. Excess of air causes the mantle to burn with a greenish-yellow tint, derived from the oxides of nitrogen, produced, it is believed, by the roasting the air gets, and not by its actual combustion. The gases produced by the combustion of cyanogen in air or oxygen are CO, CO_2, CN, N, and oxides of nitrogen. Considerable difficulty arises in separating and estimating these gases. For instance, the CN and CO_2 are aspirated together into a stoppered funnel containing barium hydrate, insoluble barium carbonate is precipitated, and by calculation gives the CO_2, while the cyanogen is converted into soluble cyanate and cyanide of barium, which are present in the clear filtrate from the carbonate. In addition to the apparatus for displaying the properties of the cyanogen flame itself, similar sets were provided for showing the effect of burning salts of copper, lithium, and gold. These salts were introduced by spraying solutions of the respective chlorides into the flame. The green color characteristic of the volatilization of copper appeared in the mantle. The brilliant appearance of lithium vapor is imparted to both cone and mantle, but a mixture of lithium and copper gives a meretricious effect. The copper may be seen in the upper flame, but it is often masked by the lithium, which colors the lower flame in every case, and when it masks the copper the upper flame becomes scarlet as well. A bead of sodium burnt in the cyanogen cone is completely masked, and it was shown that copper chloride, when heated in an ordinary Bunsen flame, yields three different zones of color, corresponding to metallic copper, copper oxide, and copper chloride. The source of the cyanogen is mercuric cyanide—a costly salt when gallons of the gas are needed.

A SIMPLE FRUIT STONER.

This implement for removing the stones from olives, cherries, peaches, etc., has been patented by Mr. Joseph Boeri, No. 626 Fifth Avenue (basement), New York City. On the forward end of one jaw is a male die in the shape of a pin, adapted to push the stone through the fruit, as the latter rests in a female die whose shank is attached to the other jaw. The latter die has a central opening and a sharp circular edge projecting into an opening of the jaw, the beveled wall of the opening forming an annular recess or chamber between the jaw and the die. By this means the stones may be readily removed from fruit without soiling the fingers.



BOERI'S FRUIT STONER.

THE OLDS GASOLINE ENGINE.

The firm of P. F. Olds & Son, of Lansing, Michigan, commenced the manufacture of gasoline engines in 1885, making an engine which contained novel and ingenious improvements, covered by their own patents, and aiming to turn out as perfect an engine mechanically as the employment of the best material and workmanship would insure. The result has been that the firm has had a steadily increasing business, and a most extensive plant is now required to produce these engines, while fifty-three more engine orders were received in 1893 than in any previous year. The engine is shown in the accompanying illustration. It is automatic in its action, using steam only for a small fraction of the stroke, and allowing for full expansion, working with great economy.

All of the rods and engine shafts are of specially made condensed steel, which is also used for all the wrists and bearings, and, by improved appliances for adjusting the bearings, the wear can at any time be readily taken up, so that after many years' use the engine is designed to run as smoothly and quietly as when new.

The engine and boiler as a whole present a neat and handsome appearance. The cylinder is jacketed with polished brass, and the steam gauge, water gauge, and safety valve, etc., are of the most efficient and trustworthy patterns. Every engine is thoroughly tested and run under full load before leaving the factory. This engine requires scarcely any attention in running, and from its extreme simplicity any one can operate it, which accounts in a large measure for its popularity in printing offices, cabinet shops, machine shops, laundries, and all places where one, two or three horse power may be required, to run with great economy, and under absolute and easy control.

THE OLDS GASOLINE ENGINE.

Distress Signals.

The Board of Supervising Inspectors of Steam Vessels, at its annual meeting held in Washington, D. C., January and February, 1894, recommended the following distress signals:

DISTRESS SIGNALS RECOMMENDED BY THE BOARD OF SUPERVISING INSPECTORS.

Article 31. (Prescribed by International Marine Conference, 1889.)

In the daytime—

1. A gun fired at intervals of about a minute.
2. The International Code signal of distress indicated by N. C.
3. The distant signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball.
4. Rockets or shells as prescribed below for use at night.
5. A continuous sounding with a steam whistle or any fog signal apparatus.

At night—

1. A gun fired at intervals of about a minute.
2. Flames on the vessel (as from a burning tar barrel, oil barrel, etc.)
3. Rockets or shells bursting in the air with a loud report and throwing stars of any color or description, fired one at a time at short intervals.
4. A continuous sounding with a steam whistle or any fog signal apparatus.

All officers and employes of the Life Saving Service will hereafter recognize any of these signals when seen or heard as signals of distress and immediately proceed to render all possible assistance.

Supreme Court Telegraph Decision.

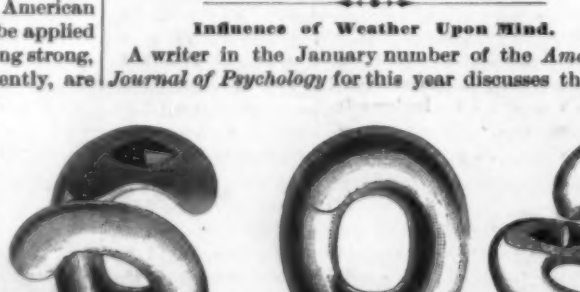
A decision of importance relating to the liability of telegraph companies in sending messages has been made by the Supreme Court of the United States. The court decides that the Western Union Telegraph Company is not liable in damages to the sender of a message in cipher for errors in transmission thereof. The case came up from the Circuit Court of the United States for the Eastern District of Pennsylvania, where Frank J. Primrose sued the telegraph company for $100,000 damages for mistakes in sending a cipher telegram from Philadelphia to Waukeeny, Kan. The message related to a transaction in wool, and the mistake, Primrose claimed, damaged him in the sum named. Judge Butler nonsuited the plaintiff in the Circuit Court on the ground that the conditions of the contract printed on the back of the telegram absolved the telegraph company from liability for errors by transmission, unless it specially insured correctness. This contract was held to be a reasonable one. Justice Gray read the opinion of the court affirming the judgment of the Circuit Court. The case has been pending in the Supreme Court since 1879.

People of ordinary intelligence not educated in the mysteries of the law will wonder why great trusts like the Western Union Telegraph Company should be exempted from responsibility for their carelessness and blunders. The Supreme Court practically holds that if you want to have your message sent correctly, you must pay double price. But if you want the telegraph company to make blunders for which you have no redress, you pay single fare.

On the same principle it would seem as if railway companies might adopt a double fare scheme, by which, unless passengers pay specially for insurance of safety, the companies will escape liability for broken limbs and other damages. All the companies need do is to print the little trick on the back of their tickets.

CHAIN LINKS DROP FORGED FROM BAR STEEL.

Our illustration shows three views, fully explaining the construction of an improved patented drop forged steel link recently placed on the market by the Philadelphia Drop Forge Company, No. 2350 American Street, Philadelphia, Pa. These links can be applied by hand, without the use of any tools, and being strong, light and compact, can be carried conveniently, are always ready for instant use and invaluable to users of chains of all kinds for mending, splicing and connecting same. Each link is accurately fitted, securely riveted, neatly finished and packed in boxes of one dozen of a size. The sizes now made up are ¼ inch, $\frac{5}{16}$ inch, ⅜ inch, $\frac{7}{16}$ inch, and ½ inch, but the company expects to manufacture larger sizes as the trade may demand. As may be seen, the links are composed of two centrally pivoted halves, which are drop forged from bar steel, and whose inner faces are each provided with a lug and recess, so that when closed for use the lugs on the faces enter the recess on the opposite sides, thus bringing the parallel faces of the lugs in contact and preventing the ends of the links from spreading or being forced open. The company also makes standard and special forgings of every description from iron, steel, copper, aluminum, and other suitable metals. On application the company will forward catalogue and price list of the Keystone open links and of their standard drop forgings, such as straight and eye-shank hoist hooks, single and double ended machine and spanner and tool post wrenches, collars or bushings, thumb screws and nuts, machine handles and eye bolts, also of standard and special bicycle forgings.

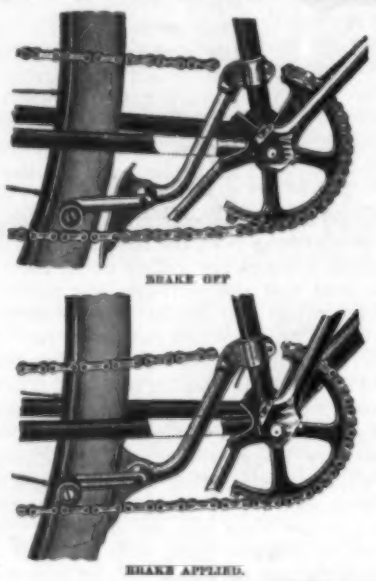


LINK OPEN. LINK CLOSED. Transparent view, showing lugs on four faces. LINK OPEN.

THE KEYSTONE DROP FORGED CHAIN LINKS.

THE BAILEY AUTOMATIC BICYCLE BRAKE.

In all of the safety bicycles, when the wheel is being propelled forward, there is noticeable a slight slack in the lower reach of the chain, which is instantly taken up by the instinctive reverse pedaling of the rider desiring to "slow down" or stop, or in descending a hill, the lower reach of the chain then becoming taut. This straightening of the lower portion of the chain effects the automatic application of the brake shown in the accompanying illustration, where one of the figures represents the brake off, another shows it applied, and the third shows the brake and its accompanying parts separate from the wheel. The improvement is a patented device of the Bailey Manufacturing Company, of No. 207 South Canal Street, Chicago; it weighs but a trifle, is not displeasing in appearance, and is designed to be in no way an inconvenience to the rider at any time. When the clamp, 1, is attached to the seat standard, the adjustable stop, 2, is set so that the roller, 6, will just clear the chain when the brake is not in use. The parts, 3, 4 and 5, are readily adjustable at any required angle, and washers are employed in setting the roller out toward the pedal or in toward the wheel. The attachment is nicely finished, durable and will fit all safeties.



BRAKE OFF

BRAKE APPLIED.

BRAKE AND ATTACHMENT.

THE BAILEY BICYCLE BRAKE.

Influence of Weather Upon Mind.

A writer in the January number of the *American Journal of Psychology* for this year discusses the subject from the view of common experience, and presents some facts that are interesting as well as leading in their directness. He says:

"The head of a factory employing 3,000 workmen said: 'We reckon that a disagreeable day yields about ten per cent less work than a delightful day, and we thus have to count this as a factor in our profit and loss account.' Accidents are more numerous in factories on bad days. A railroad man never proposes changes to his superior if the weather is not propitious. Fair days make men accessible and generous, and open to consider new problems favorably. Some say that opinions reached in best weather states are safest to invest on."

Other facts are mentioned in the psychical and physiological relation, as "Weather often affects logic, and many men's most syllogistic conclusions are varied by heat and cold. . . . The knee jerk seems proved to have another factor. It is not strange if the eye, *e. g.*, which wants the normal stimulus in long, dark weather, causes other changes."

Temperament is a fundamental factor in sensitiveness to atmospheric changes, that type of it called the mental being the more intensely affected, while the bilious type may exhibit by comparison the more capricious or morbid impressions. The mental manifestations, as a rule, however, depend upon the organism primarily. If the culture is good, *i. e.*, the faculties have been trained to co-ordinate, harmonious action, and the elements that contribute to serenity and self-control have been well developed, weather conditions will but operate like other parts of the environment, the self-training will show adaptation and self-repression. The "nervous," excitable, irascible person is he who has not learned to control feeling and expression, and it is he who finds fault with his surroundings and imputes uncanny conduct to them. That there are functional states of the body that predispose one to mental depression or exhilaration, we are ready to admit. A torpid liver, a chronic catarrh, a rheumatic joint, and even an old corn may render one susceptible to weather changes, the physical ailment producing a nerve reaction that is keenly felt at the spinal centers, and may test the spirit.

Mind, however, is superior to matter, or rather constituted for superiority. Fairly organized, carefully developed and trained, it will exhibit that superiority by its poise and calmness in circumstances that are disagreeable or painful to the physical senses.—*The Phrenological Journal.*

Jerusalem.

The British consul at Jerusalem, in his latest report, gives some interesting details respecting the state of the Holy City. It appears that buildings of various kinds continue to be erected in the vicinity, and that the city is far outgrowing its former limits. On the western side houses have increased so rapidly within the last few years that quite a large suburb has arisen where formerly there were fields and vineyards. Every available piece of land is now being bought up by private persons or by benevolent societies and missions, and already the name of "Modern Jerusalem" has been given to this new quarter. Last year the first public garden was completed outside the Jaffa Gate, and the trade is generally increasing, especially that in Jaffa oranges, olive wood work (now an important local industry), and olive oil. The export of colocynth declined in consequence of a tithe levied on it by the authorities. It is gathered by Arabs in the neighborhood of Gaza, where it grows wild. An interesting enterprise which has recently been commenced is the collection of the bitumen which rises to the surface and floats about on the Dead Sea. Two sailing boats were taken by train from Jaffa to Jerusalem, and then conveyed on carts to the Jordan, where they were floated down the river to the Dead Sea, and they are now engaged in picking up the bitumen, which is in much request in Europe. The consul thinks it would be advantageous to trade with the inland districts if a steam launch and several lighters were placed on the Dead Sea to ferry across the produce of Moab, which is a country rich in cereals, fruit, and cattle. At present it is conveyed by caravans round the north or south end of the Dead Sea, entailing a journey of from four to five days. Kerak, the chief town of Moab, is now garrisoned with Ottoman troops, and authority is established there, so that if rapid communication were established, the whole produce of Moab would find its way to Jerusalem and the coast.

Concrete Roofs.

Flat roofs have several advantages, and can conveniently be constructed of concrete, with iron or steel girders at intervals. If the under side of the concrete has to be the ceiling of the room below, it may be desirable that it should be quite flat. In this case, the necessary falls and gutters can be formed with rough concrete laid on the top of the main body of concrete. The best material for finishing such roofs externally is asphalt.

THE COAL HOISTING AND DISTRIBUTING PLANT OF THE MANHATTAN ELEVATED RAILROAD, OF NEW YORK CITY.

We illustrate in the present issue one of the plants for coal hoisting, weighing, and distributing of the Manhattan Elevated Railroad Company, of this city. It is the one supplying the Second and Third Avenue lines with fuel. The entire structure, which is built almost entirely of steel, so as to be practically fireproof, embodies the latest improvements in coal hoisting and distributing machinery. Day and night, throughout the entire year, a constant succession of locomotives back under the delivery shutes, and receive therefrom weighed portions of coal. When it is realized that the hoisting capacity of the plant is 600 tons per day of ten hours, and that in the same space of time many hundred engines can be supplied, and a quantity of coal can be stored in the yard for future use, some idea of the extent of the plant can be formed.

It is situated on the banks of the Harlem River, nearly at the end of Second Avenue. Some sixty feet above water a deck or platform is established, carried on lattice columns. This deck runs parallel with and almost directly above the edge of the dock. It is traversed longitudinally by a hoisting apparatus of the well-known type embodying the improvements of Mr. C. W. Hunt. This apparatus is shown on the upper portion of the cut. It is mounted on wheels and traverses a line of rails. On the platform of the hoisting machine is established a steam hoisting engine, with 10 × 12 cylinders, operating a 29 inch drum by 3 to 1 gearing. This engine is on the rear of the platform. From the front projects an iron boom or jib inclined downward. Near its end is seen the hoisting pulley, from which depends the bucket in which the coal is hoisted. Assuming the bucket to be in the hold of a barge and to be filled with coal, the hoisting operation is as follows: On starting the engine the bucket is drawn vertically upward until the boom is reached, when of course it can go no further in a vertical direction, but on working the engine, the bucket is drawn up along the line of the jib, as if on an inclined plane, until it is brought directly over the coal hopper. Here the latches are tripped and the bucket delivers its contents, and when empty is returned by the same path, only in a reverse direction, to the hold of the boat. The engineer stands in the little house seen on the right of the hoisting stage overlooking the water, from whose windows he has a full view of all operations.

It is evident that the place where the bucket will descend is determined by the point of the boom where the hoisting pulley begins and ends its movement along the same. This point is determined by a chock, which, by worm and chain gear, can be moved up and down so as to bring the line of descent of the bucket nearer to or farther from the dock. This gearing is operated by a rope extending from the end of the boom to the deck of the boat. The bucket employed is a self-filling bucket, also the invention of Mr. C. W. Hunt, and termed the Hunt shovel. When its latches trip and it discharges its coal into the hopper, the bucket opens at the bottom like a pair of jaws. In this position it makes its descent into the hold of the boat and rests open mouthed upon the coal. On applying the power, the bucket is forced to close. As it does so, it works its way through the coal, and when the jaws come together is completely filled. In one of the cuts, Fig. 3, we show the bucket as it appears when burying itself in the coal. It is then hoisted as described. A chain cable is employed with sprocket wheels for the hoisting operations. The bucket lifts a ton at each operation, and the entire round trip can be completed in forty-five seconds. The capacity is put at sixty tons per hour.

As coal has to be hoisted from different holds of the same barge, and as the limits of the dock admit of comparatively slight movement of the barge, the hoisting apparatus is moved on its tracks, backward or forward, so as to work the barge in any way desired. When in position, it is clamped to the rail, so as to be incapable of further movement. It is drawn back and forth by rope tackle operated by steam capstans. This shifting of the hoisting apparatus interferes with any fixed steam supply, as steam is received from one of the vertical pipes seen on the left of the cut. For each of these pipes, therefore, there is supplied a screw and lug coupling, Fig. 4, of rapid adjustment, and for each position of the hoisting apparatus there are two such pipes, one for steam supply, the other for the exhaust; the pipes are uncoupled and the next ones coupled at each movement. The apparatus can thus be shifted 12 feet at a time, and any minor adjustment is determined by shifting the boat. In one of the cuts we show the joint used for coupling the steam and exhaust pipes.

The hopper, whose edge can be seen projecting from behind the engineer's house, Fig. 1, holds several tons of coal, and is fitted with two delivery shutes. Two lines of tracks lead under these shutes, and hand cars run on these tracks.

When a car is filled it is run back and away from the dock to a coal pocket, where it is dumped after weighing. The top of this coal pocket is on a level with the floor shown in Fig. 1. Under the pocket and leading from it are five iron shutes, Fig. 2, beneath each of which shutes one of the elevated railroad tracks leads. The engine requiring coal is backed down on one of these tracks, bringing its coal box under one of the shutes. The shute is provided with a gate worked by the counterpoised lever seen in the cut, by which coal is delivered or cut off. Between the shute and the engine is a weighing hopper, virtually a prolongation of the shute proper. This is hung on a Fairbanks steelyard, on which are secured two poises, one representing the tare of the hopper, the other set at 560 pounds or one-quarter of a long ton.

The duty of the weighmaster includes the charging of these weighing hoppers. This he does by delivering coal to them until the beam nearly overbalances. The arrangements of the coal shutes and their gates are such that this operation can be conducted with great nicety. As an engine passes under the shute, the weighmaster notes its number, and it takes as many hoppers of coal as it requires, each representing exactly one-quarter of a ton. The weighmaster enters on his record, opposite the number of the engine, the quantity of coal which it took, and each day forwards his report to the office. At the same time the engine takes in a supply of water if required.

This series of operations goes on night and day, week days and Sundays, without cessation. Every week the account of coal consumed by each engine is carefully made up, and the full list, with mileage figures, is posted in the train yard, so that the engineers and firemen know exactly what each man and each engine is doing. This, it is to be assumed, establishes a spirit of rivalry among them, each being naturally anxious to get the best results.

In general operation, the boat at the dock supplies the storage. The coal is hoisted as nearly as possible at the rate at which or as fast as it is consumed. The main hopper, which has a capacity of many tons, provides for a considerable overrun. Besides this, there is a coal yard, to which as much of the coal as is desired may be delivered, and from which it may be hoisted by ordinary tip buckets.

The entire plant was designed by Lincoln Moss, assistant engineer of the Manhattan Elevated Railroad. The coal hoisting and delivering mechanism was designed by and supplied by the C. W. Hunt Company, of this city.

The Influence of Sugar and Tobacco on Muscular Effort.

In 1892 an important series of experiments were undertaken by Dr. Warren Lombard upon the influence of tobacco on muscular effort. The same subject has been investigated by Dr. Vaughan Harley, and the results of his observations are recorded in the first part of the *Journal of Physiology* for the present year.* Dr. Vaughan Harley agrees with Dr. Lombard in considering that the amount of work done by the same set of muscles at different times of the day undergoes periodical variation: so we may accept as a fact that there is a diurnal rise and fall in the power of doing voluntary muscular work, in the same way as there is a diurnal rise and fall in bodily temperature and pulse. It is remarkable, however, that instead of the greatest amount of work being done, as might have been expected, on rising in the morning, after a good night's rest, it is found that at 9 A. M. the smallest amount of work is accomplished, the powers of doing muscular work in Dr. Harley's case increasing each hour up to 11 A. M.

Immediately after lunch there is a marked rise, followed an hour later by a fall, while again an hour later, or about 3 P. M., the amount of work accomplished reaches its maximum. Then, from some unexplained cause, there is a notable fall at 4 P. M., which is succeeded by a rise at 5 P. M., after which a progressive fall takes place during each successive hour until dinner. Even during a prolonged fast more work was capable of being executed from 11:30 A. M. to 4:30 P. M. than at 9 A. M. Dr. Harley admits, however, that further experiments are required to determine this point satisfactorily. It was found in his experiments on the muscles of the middle finger that, in corroboration of a well known physiological fact, regular exercise caused increase in the size of the muscles brought into play, and at the same time up to a certain point rendered them capable of performing more work. Sugar, taken internally, proved to be a muscular food, since, when taken on an empty stomach, there was on that day an increase of 25·6 per cent in the work done by the left middle finger, while the right middle finger showed an increase of no less than 32·6 per cent. Dr. Harley varied the experiment of administering sugar in many different ways, but always with the same result. The vigor of the muscles was always augmented. The influence of tobacco was not so marked in Dr. Harley's experiments as in those of Dr. Lombard. Dr. Harley considers that moderate smoking in one accustomed to it neither increases the amount of work nor retards the approach of fatigue. It, perhaps, slightly diminishes muscular power and hastens the onset of fatigue. Dr. Lombard holds that the use of tobacco has a powerful influence in this direction.

Such experiments as these, even when no absolutely definite result is arrived at, are of importance, and if carried out, with due precautions against error, in a large number of men would undoubtedly constitute the most satisfactory basis on which a sound system of training should be carried out.—*The Lancet.*

* Both Dr. Lombard's and Dr. Harley's experiments were performed in the same way, viz., by connecting the middle finger by a cord with a weight running over a pulley and ascertaining the distance through which the weight could be lifted in a given time.

Dangers that Lurk in Flowers.

According to the *N. Y. Sun*, science has succeeded fairly well in making humanity shudder over every bite or sup it takes, because of the deadly microbes that are said to abide in everything eatable or drinkable, and now it has started off on an entirely new crusade. You mustn't smell flowers now, or, if you do, you take the consequences which science says this æsthetic pleasure entails.

A very learned French specialist, M. Joal, has just issued in Paris a treatise bearing the title "Le Danger des Fleurs." He writes most profoundly of the chemical decomposition of the atmosphere caused by the odors given off by flowers, and the consequent great increase of carbonic gas; of the partial asphyxia which results to human beings breathing this vitiated air; and of the poisoning of the system caused by inhaling the emanations of the essential oils contained in flowers. He backs up his assertions as to the subtile viciousness of flowers by citing individual cases.

M. Joal says the smell of flowers is especially injurious to the vocal organs. The rose, and others flowers with a strong scent, should, he protests, be avoided. He knows of operatic singers who have completely lost their voices through their passion for certain flowers. To some persons the perfume of the violet is particularly injurious. Others should avoid the lilac, and others the gardenia. Personal susceptibility has much to do with the injurious effects that may result from smelling certain flowers, and M. Joal cannot, therefore, say what particular flowers should be avoided by certain temperaments.

The writer cites a case of a young woman who used invariably to faint at the smell of orange blossoms. The curious conjunction of a susceptible young woman and a bridal wreath in this illustration might lead to the supposition that there is more in the case than M. Joal makes apparent. He tells of a soldier who lost consciousness under the effect of the odor from a peony, and alleges that persons have been known to suffer a violent attack of coryza from smelling roses. It is suggested that a great percentage of the headaches, colds in the head, and the like ailments from which people, especially women, suffer, on the morning after attending a ball, dinner party or other social function, is a direct result of the odors of the floral decorations. This will, at least, be useful in supplying a new excuse to the man who wakes up in the morning with "a head."

As to the evil effect of flowers on the voices of opera singers, the teacher Faure, in his work on the voice and singing, cautions singers against keeping flowers in their homes or in their dressing rooms at the theater. Mme. Richard, of the Paris Opera, forbids her pupils to have flowers about them, and it is asserted that Mme. Krauss, one of the star singers now at the Opera, refuses to stay in a room with a bunch of violets. Another singer can stand the smell of roses, but the perfume of lilacs makes her hoarse. Even Mme. Calve is cited as saying that she suffers from dizziness and headache after sitting in a room containing tuberoses or mimosa. She is quoted as giving an instance where, after singing at a concert, she received a bouquet of lilacs, and after inhaling the perfume a minute or so, she completely lost her voice, and did not regain it until she had taken a walk in the open air.

This suggests a serious consideration of the custom of presenting bouquets of flowers to singers, or of sending boxes of flowers to one's best girl. In fact, if M. Joal knows what he is talking about, science's new crusade means revolution, as well in the world of fancy as in that of fact.

Prof. Romanes.

Science has sustained a severe loss in the death of Prof. Romanes. He was born in Kingston, Canada, in 1848. His boyhood was passed in England, France, Germany and Italy, and he was educated by tutors and in private schools. In 1867 he entered Gonville and Caius College, Cambridge, where he graduated in 1870. In 1873 he was Burney prize essayist and was Croonian lecturer to the Royal Society in 1875. He was made a fellow of the Royal Society in 1879, after publishing valuable papers on the Medusæ. The University of Aberdeen conferred the degree of LL.D. upon him in 1881. He was early acquainted with Darwin and never ceased to be an enthusiastic member of the Darwinian school. Prof. Romanes published many works on natural history and was well known as a lecturer before the Royal Institution, the Royal Society and other learned bodies.

A CURIOUS TREE GROWTH.

The accompanying illustration, reproduced direct from a photograph, represents one of those peculiar and unusual tree growths of which we have heretofore published several striking representations. The trees thus joined stand about twenty feet apart, are each over a foot in diameter, and it is impossible to tell which tree originally sent out the joining limb, which is about twelve feet from the ground. The trees are beeches, and we are indebted for the photograph from which our picture is made to Mr. Bert Ames, of De Ruyter, N. Y.

A CURIOUS TREE GROWTH.

The Inconceivable Velocity of Arcturus.

Mr. Serviss, writing in the New York *Sun*, says: Arcturus, which exceeds our sun several thousand times, perhaps, in light-giving power, is apparently a runaway in the universe. As far as is known at present, Arcturus is both the largest and the most swiftly moving body in the stellar heavens. Its calculated velocity is no less than 375 miles in a second, or 32,400,000 miles in a day! The direction of its motion is such that it approaches the earth at the rate of 3,450,000 miles a day. But even if it were rushing at us in a straight line, 85,000 years would elapse before the encounter could take place. Nobody has been able to guess how Arcturus got started at its present rate of traveling, or where its journey will end. If it is only a gigantic visitor to our system of suns, then it will pass through the visible universe, and in the course of millions of years disappear from it. And if any member of our system should, through too close approach, become a satellite of Arcturus, it would inevitably be borne away a prisoner into the unfathomed and, by human eyes, unseen depths of illimitable space.

THE RUDOLF MULLER BOILER FURNACE ON THE STEAMSHIP GRIMM.

The application of improved boiler firing systems to ships is naturally an operation of considerable difficulty. The restricted space at disposal for the boilers makes many regenerative, gas and firing systems impracticable for use at sea. The motion of the vessel in a seaway is also a disturbing element which must be taken into account. There is, therefore, much interest attached to the arrival at this port of the steamship Grimm, of the Hamburg-American Packet Line, which vessel has just completed a voyage with an improved boiler furnace with most satisfactory results. The Muller furnace, which is the one alluded to, is not a new thing. It is in very extensive use on the Continent of Europe for stationary boilers. Its practicability at sea has now, it is believed, been established.

The apparatus is applied to the boiler, whose grate bars are removed. A rectangular chamber with double sides is fixed in front of the boiler with an opening for the flames, directly opposite the original door aperture of the boiler. The chamber is built of boiler iron. On a level with the lower edge of the door of the boiler is the grate, of common horizontal type, which fills the entire horizontal sectional area of the chamber. The front of the chamber has three doors. One near its top is the coal or firing door; one on a level with the grate is the cleaning door; a third is near its bottom and opens into the ash pan. The doors are provided with dampers to regulate the admission of air.

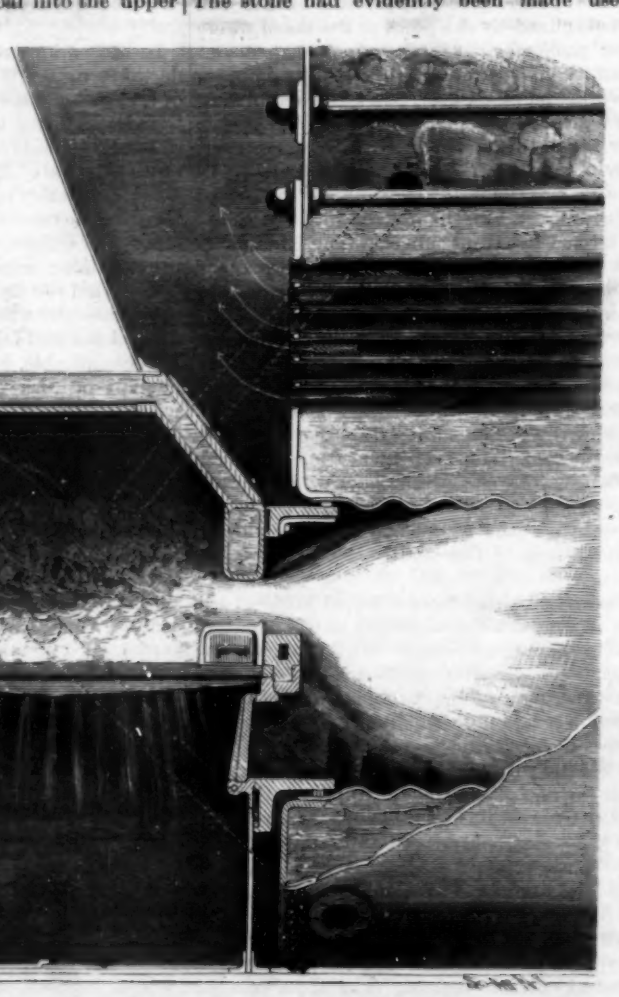
The double walls, the space between which is filled with water, are in two sections. The lower section, which is stayed, connects by two pipes with the boiler, so that the water in it circulates and forms part of the active contents of the system. The upper section is kept full of water, but does not connect with the boiler.

The fire is started on the grate as in an ordinary furnace. When a hot fire, six inches thick or more, has been produced, the firemen shovel coal into the upper door until the chamber is filled up to its level or more. This may represent half a day's fuel. The upper door is closed and the dampers on it and on the ash pit door are regulated to bring about perfect combustion. The air entering the ash pit door keeps a hot bed of coal upon the grate. The air entering by the firing door penetrates the bed of coal and works its way down toward the grate. The gases produced enter the former furnace chamber of the boiler. Air which has drawn down from the upper door enters along with them and an intense combustion ensues, filling the space with a white hot flame. As the damper on the lower door is opened more widely, the hot bed of coal increases in depth and less air enters from above. As this damper is closed the reverse takes place, the hot bed of coal diminishes and a greater proportion of air enters from the upper damper. Analogous actions obtain for the dampers on the upper or firing door. It must not be understood that all the air which enters by the upper dampers finds its way through the coal unaffected. Much of its oxygen is consumed before it enters the boiler proper. But by setting the dampers in the required relation to each other the amount of oxygen left unconsumed can be adjusted so as to insure complete combustion of all gases before they leave the furnace chamber of the original boiler. Peepholes at the side are provided through which the flames can be watched. They appear almost as bright as an electric arc light.

The fire on the grate with a mass of coal above it is not a very hot one. This prevents the formation of slag, of which but a small quantity is produced. Most of the ashes appears as a sort of sand, and the slice bar has but little work to do. Handholes for cleaning out sediment are provided in the lower section of the water chamber.

The Grimm was provided with Scotch tubular boilers, with Fox corrugated furnace chambers. The Muller furnace was applied directly in front of these, their doors having been removed. The original boilers are left virtually intact. A saving of over thirty per cent of fuel, it is claimed, is secured on the Grimm. The firing is made much easier for the men, and the entire absence of smoke from the smokestacks is described as being very noticeable.

THE MULLER BOILER FURNACE—FIRING ROOM ON THE STEAMSHIP GRIMM.



SECTIONAL VIEW OF THE MULLER BOILER FURNACE ON THE STEAMSHIP GRIMM.

AN account is given in *Nature* by Mr. R. Philip, of Buenos Ayres, of an interesting instance of the use of a stone by a spider as ballast for his web. A web was noticed stretched between two trees, at a distance of about ten feet from one another. From it hung a thread about two feet long, and attached to its lower end was a small pebble about the size of a pea, the stone hanging free about four feet from the ground. The stone had evidently been made use of in this special manner by the spider for the definite purpose either of keeping the web taut, or as ballast to give it stability against the wind; for on lifting the stone to remove the pressure, it was observed that the web became limp and slack, and was stirred out of position by the least breath of air. This was noticed by a score or so of members of the German Turnverein there, in the garden of whose premises the occurrence took place.

FLOWER AND FRUIT OF THE MONSTERA DELICIOSA.

(Philodendron pertusum).

The Monstera deliciosa occupies a prominent place among the larger plants that are oftenest seen in the parlor and living room, and it is difficult to imagine any foliage decoration that is more beautiful and ornamental than that afforded by this plant. For this reason and because the stately liana requires comparatively little care and attention, it has found many friends and admirers, who are richly rewarded by its abundant and luxurious growth for the little trouble they expend upon it. But, although this child of the tropics is so well known, very few have had the satisfaction of seeing a blossom or even a picture of a blossom of this plant, and, therefore, when, by a happy accident, I had this rare pleasure, I determined to publish a little study of the plant with a good, clear illustration of the flower.

In the first place, it should be stated that the plant of which we are speaking is the Monstera deliciosa, and it is only through error that it is called philodendron. Philodendron pertusum, that is, perforated, referring to the holes in the beautifully formed leaves. The home of the liana is southern Mexico and Central America, where it grows in great abundance, especially on the western slopes of the mountain ranges. Even in our rooms it presents an imposing appearance, but how much more beautiful must it be there, where it winds its slender, flexible stem around the supporting tree until it reaches its crown, and then spreads out its shining leaves. I have not been able to learn the name given to the plant in its native land, but as far as its scientific name is concerned philodendron is certainly much more significant than monstera, for the former means "loving trees," seeming to refer appropriately to its habit of clinging to strong trees. But, on the other hand, the word used to indicate the species (deliciosa) is a truly characteristic epithet, for the fruit of the monstera is not only edible, but delicious. In Guatemala and Mexico this fruit is carried with others to market, where a young friend of mine saw it. Its flavor is similar to that of the pineapple.

The Monstera deliciosa does not blossom when growing in a pot or tub in a room, and it seldom blossoms even in a hothouse, because it has not sufficient earth, nor does it, as a rule, reach the requisite age. The specimen that furnished the blossom for our illustration stood in the great aviary in the Berlin Zoological Garden, and was about twelve years old. It was about 26 feet high and had plenty of room both above and below ground for perfect development. The diameter of its stem was from 1 to 1½ inches and from it hung many "air roots." The blossom was at the top in the center of a crown of leaves. At first, before it opened, it was shaped like a spindle or a thick cigar; later the spathe unrolled and formed a canoe-like or shell-like envelope standing parallel to the spadix, which bore the flowers and later the fruit. When ripe the spathe fell off. This whole blossom was cream colored, the spadix being a little darker. The latter is given a pleasing spiral effect by the little flowers, which remind one of the little cells in honeycomb.

FLOWER AND FRUIT OF THE MONSTERA DELICIOSA.

The perforations in the leaves are caused, as is well known, by the uneven growth of the web between the veins, and if the delicate edge happens to be torn here and there, these tears are liable to run into the perforations, giving the leaf a ragged appearance.

The plants most closely related to the monstera or philodendron are the reed mace (typha), the sweet flag (acorus), the arum and the calla, or more correctly the richardia, which are readily recognized by the similarity of their blossoms.—*Dr. J. Mueller-Lieberwalde, in the Illustrirte Zeitung.*

How One Feels with the Grip.

The *Insurance Journal* describes in an amusing way the misery of a person having an attack of the grip, and still the picture is not very greatly overdrawn.

Ever had the grip? I will give you a few pointers. You will imagine you have a bad cold and you can wear it out, but you need not try it. The grip has fastened his fangs on you and will not let go. You have got to give up, go home, and go to bed. In a short time you will feel like the Chicago drummer who took the Keeley cure at Dwight, Ill.

You will feel like an anarchist and want to bomb. You will realize Beecher's dream of hell. You will think your head has been removed, and an old beehive with the empty comb left in its place. Your mouth will taste like a pail of sourkrout. You have the grip.

The doctor comes, looks you over, puts his thermometer in your mouth, finds your temperature 104° in the shade, your pulse going at the rate of two miles and three laps to the second. He orders you to stay in bed and gives you medicine that is so strong and sour that simply setting the bottle on the clock shelf stopped the clock.

He will tell your wife that she may give you warm drink and try and get you to sweat, and takes his leave. Now all wives are family doctors by right of their position in the house, and as you have gone to sleep, delirious and exhausted, she begins her treatment by putting a belladonna plaster across your lungs, a flaxseed poultice on one side and a mustard poultice on the other, a hot flatiron and a jug of hot water to your feet, and a sack of boiled corn in the ear, piping hot, to your back.

You sleep and dream of being away to the far north in search of the north pole or out in the center of some beautiful sheet of water like Lake Superior, or the lawn tennis skating rink, helpless and alone, with the ice breaking all around you and you slowly sinking. Your finally awake, burnt, blistered, and baked. The doctor calls, finds your temperature about 80° at the north side of the house and your pulse normal, not needing a peacemaker.

He pronounces you better, convalescing. Orders beef tea, chicken soup, gruel, and toast as a diet. You take the big rocking chair exhausted, tired, discouraged, and ugly; you feel like licking your wife, kicking the dog, and breaking up the furniture, but you won't do anything but sit there day after day, weak, helpless, and tired.

Fashion in Fishes.

There are fashions in fishes just as there are in dogs, cats, horses and bonnets. The "fish fad" is in imitation of the Oriental custom of having valuable fishes as household pets, and they bring fancy prices. A trip to Mikado-land has been "all the go" of late years. Now, in Japan, families of moderate means have their jars of fine fishes. In the aquaria of the noble Japanese families are to be found species of odd and curious fishes that have been bred and cultivated for the past five hundred years. Thus, the paradise fish, like the German canary, is a product of cultivation, as there is no place where it is found in a wild state. It is a native of China. There the fish have been cultivated for hundreds of years. The stock is kept pure, and the Chinese raise specimens, perfect in form, fin and color.

At his country seat a well-known New York banker, writes L. J. Vance to the *Pittsburg Leader*, has a fine specimen of the Chinese paradise fish. There is, perhaps, not another specimen of this variety in the new world. The paradise fish is an ornamental fish, cultivated for the aquarium in China. What makes this fish remarkable are its colors, which surpass in brilliancy any fish bred for the purpose. In shape and size its body is not unlike that of the pumpkin-seed sunfish. Here are some of the colors and marking. The side of the body and the crescent-shaped caudal fin are deep crimson, the former having ten or a dozen blue stripes, while the fin has a blue border. The gills are blue, bordered with bright crimson. The head is gray, with dark spots. The remarkable feature of the paradise fish is the under surface of the body. This is continually changing color—at one time it is white, and at another time it is gray or black. The dorsal fins, which are unusually large, are striped, dotted with brown and bordered with blue. The ventral fins are dull colored. The pectorals are transparent and show no color. Altogether the paradise fish is a wonderful product.

Another ornamental fish which is interesting is the Chinese comet goldfish. It attracts attention on account of its immense caudal fins, which spread out like sails when the comet fish is swimming. The scaleless goldfish is common in Germany. As the name would indicate, the peculiarity of this goldfish is that the body is entirely without scales. Here one sees the heart, the vertebral column, and the divided air bladder, by means of which the fish are able to rise or sink at will. The whole internal machinery of the fish is open for inspection. To supply the demand for odd and curious fish, the dealers send for specimens in different parts of the world. They know that if they can obtain a "freak," they can secure a good price from their wealthy customers. On this order is the pair of white axolotl from Mexico, which are to be seen in the aquarium of a New York dealer. These Mexican "freaks" are batrachians with four feet and tails. The brown variety are not uncommon, but the white axolotl live in the dark, and if they are exposed for any length of time to the sunlight they change their color and become brown. The peculiar feature of the white axolotl is that the exterior gills are so transparent that the circulation of the blood corpuscles can be readily seen under a magnifying glass.

Mathematics.

Mathematics should be regarded as a kind of mental shorthand; a ready means for stating a proposition exactly; an instrument for recording thoughts so that they cannot be misconstrued. It is no longer to be associated with things uninteresting and vague; the reverse is undoubtedly the fact; to a mathematician, there is as much delight in the solution of a problem as a musician finds in composing a sonata. Mathematics is not essential to the art of theorizing, but it is essential to the art of theorizing rightly; it is the only economical method of thought. It was Darwin's belief that "no one could be a good observer unless he was an active theorizer." Then, too, a mathematician can generally give points to a logician in a subtile argument, for it implies no trickery stronger than the truth.—*The Electrical Review.*

How to Get Rid of Cutworms.

BY C. V. RILEY.

Young corn is often grievously injured by cutworms. The following reply, by Prof. C. V. Riley, to a correspondent who has been more than usually troubled will, therefore, be read with interest at this time:

If specimens of the particular cutworms were sent to the station for identification some preventive measures might be suggested, as much depends on the particular species. In a general way, most of the species have similar habits in the larval state; but to deal directly with them when, as in this case, they are distributed over large areas, is a very serious problem. The most successful means under these conditions is by the distribution of poisonous baits. These may consist of freshly cut clover or other succulent vegetation poisoned with Paris green and made into balls or gathered into masses, so as to prevent their too rapid drying. One mode of accomplishing this last object is by covering the poisoned plants with boards. These poisoned baits, if placed at intervals along the corn rows, will attract a large proportion of the cutworms, which, by feeding upon them, will perish. For smaller areas, or for garden patches, the same method may be followed, or the larvæ may be unearthed from about the base of the plants, where they retire for concealment during the day.

Another method is to take a smooth walking cane and make smooth holes several inches deep at intervals, going over the same ground every day and punching in these holes to destroy the worms which seek them during the day as a place of concealment and tumble in. The patent salts, such as kainit, have proved of the greatest value against many subterranean insects, and undoubtedly will be of value against these cutworms. They have the additional advantage of being good fertilizers, so that their expense as insecticides is more than offset by their value to the crop and to the land. I think with your correspondent that it is too late to accomplish much the present year, but by a combination of the three methods suggested he will be able another year to prevent much of the trouble. It is well, where fields are badly infested with cutworms, to plant thickly, so that two or three young corn plants may be spared from each hill without seriously affecting the crop. It is also wise, on general principles, to keep fields that are to be planted to corn thoroughly clear and clean of weeds and other vegetation during the fall; and in this light fall plowing becomes extremely important, as most of the cutworms are hatched the previous year and hibernate as partly grown larvæ.

Poultry Fattening.

A large party of ladies and gentlemen interested in the poultry industry lately visited the Iville Poultry Farm, at Baynards, near Horsham, Eng., the property of Mr. C. E. Brooke, Master of the Poulterers' Company. The business of rearing and fattening chickens has been carried on for a considerable time in various parts of Sussex and Surrey, and notably in the districts around Heathfield and Uckfield. In some of the largest establishments as many as 6,000 chickens may be undergoing the fattening process at one time; at the other extreme we find small farmers or cottagers who only prepare a few dozen birds at once. The district is scoured by higglers, who buy chickens from the breeders, often giving as much as 3s. 6d. to 4s. in the spring for well grown birds nine or ten weeks old. Quite recently a demand has sprung up for birds of only a month old, at which age they can be served up as great delicacies at table. As seen recently, the establishment was in full working order, and the various processes of rearing, fattening, cramming, killing, shaping, and dressing fowls were illustrated and described. The Indian game and Dorking cross is found to be the best for producing birds for the table, as they readily lay on flesh at the parts where it is most desired. The cramming house is capable of accommodating a total of 632 fowls, and the birds enter upon this, the last stage of their career, at ages ranging from four to seven months. The pens or cages are arranged in horizontal tiers, one above another, all round the house, which is kept scrupulously clean. Each pen holds one bird, an arrangement which prevents any waste of energy in unseemly quarrels. For two weeks before killing the birds are fed solely by cramming. The food consists of a mixture of barley meal, oatmeal, and skim milk, together with the best beef and mutton fat obtainable, the proportion of fat being increased day by day. The cramming machine is a light contrivance which the attendant can wheel along in front of the pens. To feed a bird he takes it out of the pen and places his left hand on the crop, into which with his right hand he guides an India rubber tube from the machine. By pressing a treadle with his foot, he forces food into the bird's crop, the contact of his left hand with which enables him to judge as to the amount which should be allowed. A careless or inexperienced attendant might easily burst the crop by surcharging it, but a smart man will safely feed 100 birds from the machine in the space of 20 minutes. Feeding in the cramming house takes place twice a day, at 7 A. M. and 4:00 P. M. The birds show no aversion to the cramming operation; indeed, the clamor that is raised as soon as the machine appears and the number of hungry fowls to be seen stretching their necks beyond the bars of their pens raise in the mind of the onlooker a suspicion that just once in a generation a bird may lose its meal unless it enters upon an audible remonstrance with the attendant. As soon as the feeding is over the blinds of the skylights are drawn down, and the birds are left in quiet and semi-darkness to digest the meal they have received and to acquire an appetite for the next. The pens are only large enough to permit the birds to turn round, so that the wear and tear of muscle which would be involved in running about are avoided. Besides the plump young birds which are thus fed up, old and quarrelsome fowls are fatted and sold for making soup. The output of birds from this farm is about 5,000 a year.

Natural History Notes.

Irritability of Plants.—In an address upon this subject Prof. Pfeffer points out that irritability is a fundamental quality existing in all plants, these organisms having the same power of reaction as animals. An increase of stimulus in plants, too, produces a dulling of sensitiveness. At the same time a plant or plant organ is never sensitive to a single stimulus only, and different stimuli do not produce one and the same effect in a given cell. While plants exhibit a variety of sensibilities equal to that of animals, the vegetable kingdom has the advantage in delicacy of perception, bacteria being attracted by a billionth or trillionth of a milligramme of meat extract or of oxygen.

Experiments with Dodder.—Mr. G. J. Peirce records in the *Annals of Botany* the results of a number of experiments with several species of dodder (*Cuscuta*). These are parasitic climbing plants, which, at certain stages, twine around the host plant as the result of the combined effects of circumnutation and geotropism, and, at others, by contact-irritation, which modifies the manner of coiling and accelerates its speed. Haustoria are usually found upon the concave surfaces only of the close coils, and are the result of irritation, their development depending upon contact and nourishment.

Chlorophyl is frequently absent from these plants, but is formed whenever they are insufficiently nourished, and the intensity of the green color may then serve as an index of the amount of organic food they are receiving. The only plants open to attack by the parasites are those whose size, peripheral tissues, internal structure, cell contents and secretions allow to be closely embraced and readily penetrated by the haustoria, and whose conducting tissues speedily unite with those of the parasites, while they produce no poisonous effects by their cell contents or secretions. Such changes as take place in the host plants are rarely anatomical, the effects being mainly physiological. Then penetration of the haustoria is effected by means of mechanical pressure and the chemical activity of the pre-haustoria and cells at the tips of the haustoria proper, aided by the action of the cushion cells. The pre-haustorium consists of the long papillate cells in the center of the "cushion" of older authors, and the cushion cells are the other modified epidermal cells. The tips of the latter partially dissolve and fuse with the walls of the opposite epidermal cells of the leaf attacked, and thus securely hold it, while the papillate cells of the pre-haustorium perforate the walls by more complete solution, and, growing through the holes thus made, enter the mesophyl of the leaf.

The stem of the parasite can then brace and so assist the forward growth of the haustorium, which grows through the center of the area of attachment, and advances by the way partly excavated by the papillate cells.

Flight of the Frigate Bird.—Mr. J. Lancaster, who has spent five years upon the west coast of Florida in the study of the habits of aquatic birds, of which he has made a specialty, asserts that he has seen frigate birds fly for seven consecutive days, night and day, without ever resting. According to his observations the fatigue of these birds is not excessive, even in such long continuances in the air. In fact, the frigate bird can easily, and almost without a flap of the wings, not only maintain itself, but also fly with a speed of nearly a hundred miles an hour. The spread of the wings extended varies between 11 and 13 feet. It feeds, gathers materials for its nest here and there, and even sleeps on the wing. This well proves that in this bird the motion of the wings is, in a manner, independent of the will.

The albatross, which also has been the subject of Mr. Lancaster's observations, is larger than the frigate bird, its wing-spread reaching at least 16 feet; but if it follows ships at sea for a long time, it is always obliged to take a rest upon a rock or upon the ship itself at the end of about four or five days.

Chemical Defenses of the Beetles.—In addition to their chitinous cuirass, which is sometimes very thick, the coleoptera are very often provided with chemical defenses in the way of nauseous or caustic liquids secreted by the anal, salivary, or tegumentary glands, and which they expel upon the least provocation. These defensive liquids are not always glandular secretions, however. In fact, however surprising it may appear, Mr. L. Cuenot has ascertained that in a certain number of beetles it is the blood itself of the insect, charged with noxious products, that makes its exit from the body through fissures in the integuments and protects them against the attacks of ferines.

Mr. Cuenot thinks that the principles that give the blood its defensive properties vary with the species. Thus the blood of the Coccinelidæ has quite a strong and very disagreeable odor, which, moreover, is that of the entire insect, while the blood of the Timarchæ is odorless, but has a very persistent astringent taste, and, in *Timarcha primelioides* (according to the researches of De Bono), contains a venomous product, capable of poisoning flies in a few minutes, and of rapidly killing, through stoppage of the heart, Guinea pigs, dogs, and frogs. Finally, in the Meloidæ, it is well known, from the researches of Leydig, Bretonneau, and Beauregard, that the blood contains a large quantity of cantharidine, the vesicatory properties of which make of it an eminently defensive product. This singular means of defense is, up to the present, known to exist in but three groups of coleopters, viz., among the Chrysomelidæ, in numerous species of the genera *Timarcha* and *Adimonia*, and probably the *Megalopi* of equatorial America; among the Coccinelidæ, in the majority of the *Coccinellæ;* and, finally, among the Meloidæ, in the genera *Cantharis*, *Lytta*, *Meloe*, *Mylabris*, *Ceracoma*, etc. It is probable, adds the author, that we shall find it in still other insects.

Insectivorous Habit of Dionæa.—Mr. B. Dean, from observation of the Venus' fly trap (*Dionæa muscipula*) in its native habitat, states (Trans. New York Acad. Sci.) that the position of the trap is more adapted for the capture of creeping than of winged insects. A far larger quantity of the remains of the former were found in the traps than of the latter, the escape of the larger winged insects being also facilitated by the slowness with which the trap acts. The leaves frequently close on vegetable and even on inorganic objects when captured. After digestion has taken place, the position of the trap, when reopened, allows the undigested particles to fall to the ground. The sensitiveness is not confined to the bristles, but belongs in a modified degree to the whole of the upper surface of the leaf.

Rhythmic Growth.—Mr. Thos. Meehan gives illustrations (Proced. Philada. Acad. Nat. Sci.) of rhythmic or interrupted growth, in contrast to continuous growth, in the case of the fruit of a number of species of *Citrus*, especially in the Tangerine orange and in a variety known as the "navel orange," in which there is an attempt to form another fruit at the apex, usually accompanied with a failure to produce seeds. Further instances are afforded by the proliferous growth of the flower frequent in many Rosaceæ, and in the development of the inflorescence of two species of Compositæ, *Heliopsis lævis* and *Bidens bipinnata*.

A Russian Factory.

In speaking of Russian industry, the name of Morozof comes first to mind. The Morozofs have done most for the cotton industry in Russia, and it is due to them that this industry has produced goods which rival those made in other countries. One of the most celebrated Russian manufactories, that of Bogorodsko-Gloukhof, belongs to one of the members of this family, Arsene Morozof. This has made immense progress under his intelligent direction. In the period of twenty-five years the business has increased from 900,000 to 13,000,000 rubles. [Value of a ruble is $0.75.] There are now 8,500 workmen employed, of whom only 2,000 lodge outside of the factory. All the workmen and foremen are Russians; the spinning only is directed by an Englishman. The works use annually 5,600 tons of cotton, of which 1,280 tons are bought in Central Asia; the rest comes from America and Egypt. The Asiatic cotton of Bokhara is used only for stuffs of inferior quality; the Asiatic cotton produced from American seed is superior to it. But the best kinds of cotton are those from America and Egypt.—*Revue Francaise.*

Imitation Agate.

Mr. Solms-Baruth (Silesia) has recently patented a process for the manufacture of an imitation agate, obtained with the following composition:

Basalt	100 parts.
Soda	50 "
Borax	10 "
Carbonate of lime	90 "
Sand	80 "
Chloride of silver	1 part.

Into the molten glass are introduced fragments of basalt, lava, scoriæ, iron ore, or roasted pyrites, and then bichloride of tin is added to the mixture. Through the effect of the incomplete dissolving of the basalt, the appearance of agate is given to the mixture. Upon cooling the surface of the glass more rapidly, there is obtained a better effect, which consists in the production of a deeply colored surface upon a dark ground.—*Revue Scientifique.*

THE GAS AND GASOLINE ENGINES OF THE GLOBE GAS ENGINE COMPANY, OF PHILADELPHIA, PA.

The gas engine has been recognized by engineers as affording one of the most efficient prime motors known. The steam engine is far more wasteful of the energy received from its fuel when steadily running. Irrespective of this fact, a further source of waste, which may be of still greater degree, is that for intermittent power much of the fuel in a steam boiler furnace may be burned uselessly. When a steam engine is not running, the boiler fires may go on burning fuel almost as fast as when the engine is in operation. It is only in cases of prolonged stoppage that it is practicable to draw the fires or to bank them.

With the gas engine it is different. The gas is turned off when the engine is to stop, and none is used until it is wanted. The steam engine is stopped by shutting off steam; the gas engine is stopped by shutting off fuel. This is a radical distinction.

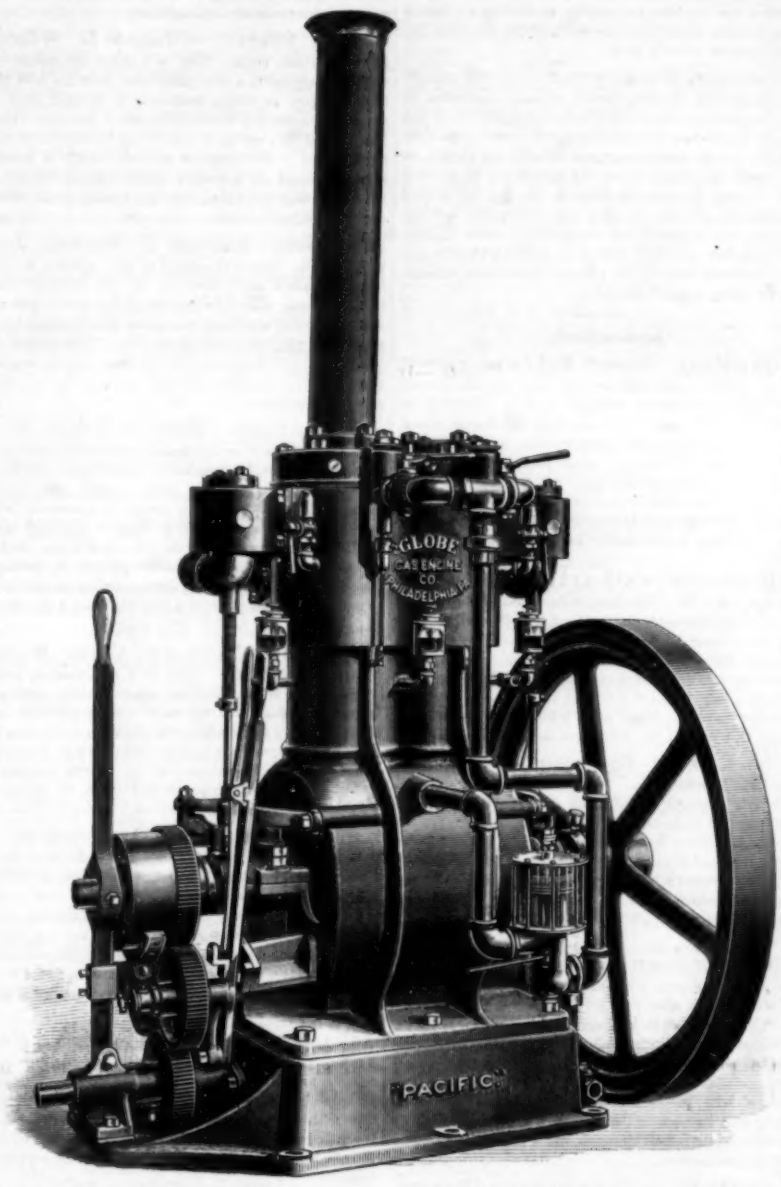
We illustrate in this issue two of the several types of engines manufactured by the Globe Gas Engine Company, of No. 53 North Seventh Street, Philadelphia, Pa. The horizontal is called the Union, and is intended for stationary use. The vertical engines are of both single and double cylinder types; the former being the Pacific and the latter being the Union engine. The vertical single cylinder engines are used for both stationary and marine purposes, while the double cylinder engines are only for marine uses, and receive an impulse for revolution, each cylinder acting alternately as single engines.

The Globe Gas Engine Company's engines are built to work with both gas and gasoline. Its perfect adaptation to the latter kind of fuel was shown in an experiment in which an engine was run for a long time with kerosene oil in place of gasoline. The fuel is vaporized before burning, simple atomization not being relied on, and no heat is required for the purpose.

As the energy of all engines is heat—emphatically so of internal combustion engines—extensive experiments were made in the summer of 1892 by the Union Gas Engine Company, of San Francisco, Cal., who also manufacture the Pacific and Union engines, with a view of saving this hitherto wasted power, and the result proved very successful, especially with the oil engines. After the engine has been running a short time the air for combustion is automatically heated by extracting the heat from the exhaust. Thus the fresh charge is brought into the engine in a heated state, and increased economy is the result of the recuperation. This is one of the features of these engines.

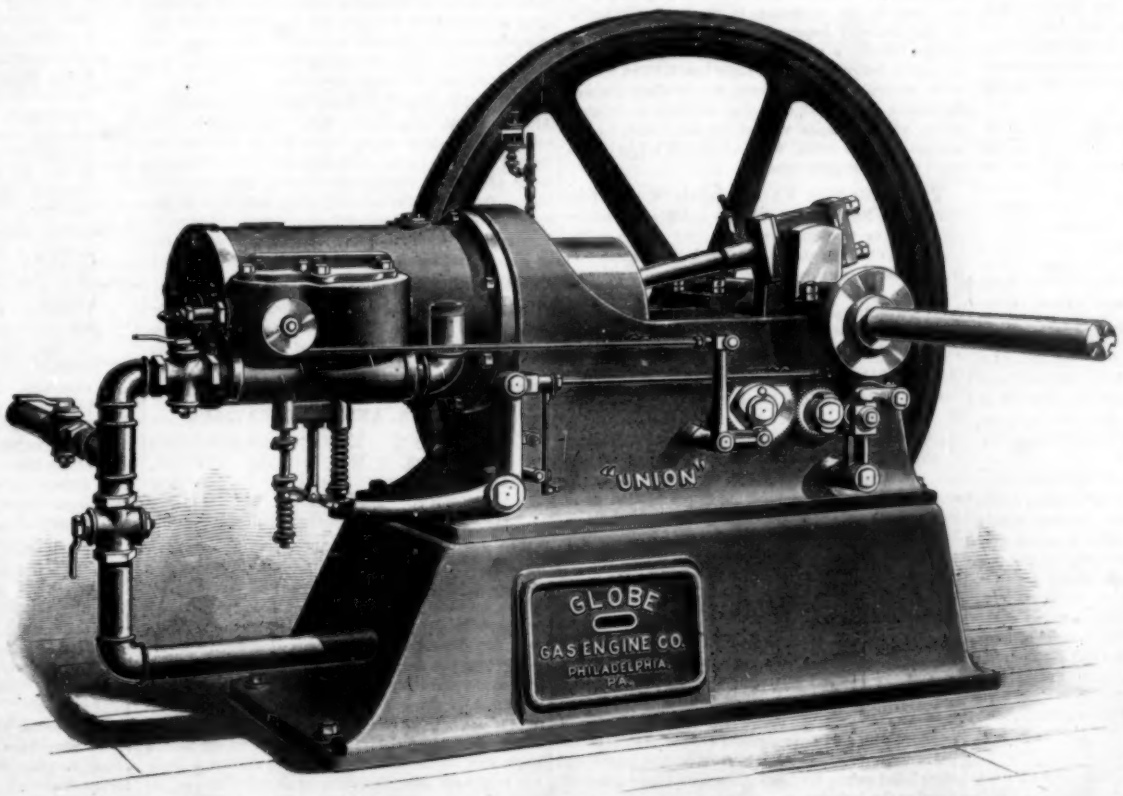
The governing device is twofold in action. It not only shuts off and admits fuel, but regulates the exhaust valve so as to prevent wasteful cushioning. The mixture of air and gas or vapor is ignited by an electric spark. This is a peculiarly valuable feature, as it does away with the hot and rapidly corroded ignition tube used in some gas engines. A great deal of trouble has resulted from the use of these tubes. Again, the electric spark is produced within the engine, so that it runs absolutely without any external fire.

The marine engines below 6 h. p. are single cylinder; from 6 to 75 h. p., are double cylinder. By a combination of friction clutch, brake, and reversing train, this engine can be thrown off the propeller shaft and recoupled for reverse motion without jar. The reversing mechanism is simple, is controlled by one handle, and is very rapid in operation. A great many marine engines are in use on pleasure launches, while a number are used on actual working boats. Of these vessels some are of quite good dimensions, one being 90 feet long with 45 h. p. (actual), and a 75 h. p. is now being built for the same party for a larger boat. The engines are adapted for all types of wheels, side wheels, stern wheels, or screws. The gas consumption per horse power hour is put at 21 cubic feet; one-eighth to one-sixth gallon of gasoline does the same service. No engineer is required, explosion is impossible, and there is no fire risk. The double cylinder engine for low power can be run on a single cylinder. These marine engines are throttled the same as steam engines, and can be handled to perfection.



MARINE GASOLINE ENGINE OF THE GLOBE GAS ENGINE CO.

DENMARK's dikes are over seven centuries old.



SINGLE CYLINDER GAS AND GASOLINE ENGINE OF THE GLOBE GAS ENGINE CO.

A Tower for Copenhagen.

It has been decided to build a tower, on somewhat similar lines to the Eiffel tower, in a park outside Copenhagen, on an elevated spot, from whence there will be an exceptionally fine view over the city, the surrounding picturesque country, the sound, and a long distance into Sweden. It will be built exclusively of iron and steel, and the foundation will be cement concrete The height will be considerably more modest than the towers of Blackpool and Paris, viz., only 430 feet, but then the locality is some 90 feet above the level of the sea. The diameter of the base will be 160 feet, and there will be three platforms, at respectively 100 feet, 200 feet, and 359 feet. The lowest platform will rest on a structure of the shape of an even sixteen-sided pyramid, and will itself be octagonal, each side being 46 feet. This platform will have in its central portion an octagonal pavilion for restaurant, etc. In the upper portion of this pavilion will be access to staircase and elevator to the upper platforms. The access to the lower platform will be by two staircases and two elevators; the capacity of the latter will be about a dozen passengers each, and their maximum speed 1½ feet per second. It has not yet been decided whether they will be worked by hydraulic power or electricity. The second and third platforms will also be octagonal, fitting into circles of respectively 54 feet and 31 feet in diameter. These will have stone floors, and the access to them from the lower platform will be by means of two staircases and two eight-passenger elevators, round which the staircases are placed. The top structure, which will be double, will, in its lower portion, be 19 feet in diameter and 31 feet high; 10 feet above the third platform there will be a floor, intended for military and other observations. The upper portion will be 9 feet wide and 16 feet high, and there will here be placed a powerful electric light. The whole structure will be lighted by electricity, but gas will also be laid on as a reserve. The cost is calculated at $165,000.

Russet Oranges.

A little item in the New York *Confectioners' Journal*, in which golden russets and small dark russets are incidentally stated to be the best keeping oranges, has called to our mind a very general experience which we have never seen referred to in print. We buy for our own table consumption russet oranges in preference to bright oranges, and yet in our official work we are in constant receipt of requests from orange growers for methods of destroying the rust mite. The hardening of the skin of the orange from the work of the rust mite undoubtedly keeps them juicy, improves them for shipment, and retards decay. The selection of bright oranges was a fad among growers and wholesale buyers which did not last. The time has come when russet oranges for shipment command higher prices and when remedial treatment for the rust mite is only necessary for a great excess of this Acarid. The change in public opinion in this matter shows that utility governs even sentiment.—*Insect Life.*

Cycling in Russia.

The bicycle is but little encouraged in St. Petersburg. Wheelmen there are restricted to the use of certain streets, which are for the most part so wretchedly paved as to make riding through them almost impossible. No person under the age of eighteen may enjoy the privilege of cycling, and no very high machines are allowed in the streets. Another order provides that after dark no cycles of any sort shall be permitted.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SWITCH.—Edward W. Coughlin, Baltimore, Md. This inventor has devised a special construction for switching across the rail of an unbroken main line, providing for so bracing the parts by each other at the point of crossing that one cannot be depressed without a corresponding depression of the others, preserving the proper fitting of the joints at the crossing, no matter how great the load. The base section of the main line rail has an extended plate with a seat for the tongue of the swing section, which is pivoted at one end on the base plate and has a tongue and a rib to fit the hollow of the main line rail.

RAIL TIE PLATE AND BRACE.—August L. Starke, New York City. This plate has on its upper side internal inclined rail braces whose inner ends fit the side of the rail, while there are parallel longitudinal ribs integral with the under side, there being spike apertures in the plate, which is composed of a single piece, and adapted to be placed on an ordinary sleeper. It is cheap and simple and easily applied, and rigidly supports the rail, and at the same time braces its sides, to prevent the rail from either turning or spreading.

BRIDGE SIGNAL.—John E. Zimmerman, Trinidad, Col. This is an inexpensive, simple and positive working apparatus, to be arranged at the side of the track at a suitable distance from the bridge, and connected with some portion of the track-supporting structure, being so arranged that when the latter is displaced in any way a signal mechanism is operated and a torpedo moved out upon the rail, where a passing train will explode it. The improvement is especially designed to give warning when a bridge is washed away or is unsafe, or when a culvert, trestle, or other part of the roadbed has been broken away.

Electrical.

BLOCK SYSTEM FOR TROLLEY ROADS.—Willard F. Lewis, Swampscott, Mass. A contact device connected with one of the trolley wire hangers is arranged to make contact with the line wire, a second contact device making a contact for a day or night signal, as a lamp, while an electro-magnetic releasing apparatus is connected with the contact devices for extinguishing the lamp after a car has passed a turnout. The improvement is more especially designed for single track roads, to guard turnouts and prevent cars from making long waits, as well as to prevent collisions between cars moving in opposite directions.

CUTOUT AND CORD ADJUSTER.—Edgar D. Knap, Schenectady, N. Y. This is a device to hold the safety fuse or thermal cutout in the branch circuit in position of use, the cord adjuster also varying the length of the cord connected with the lamp or other translating device. It comprises a casing in spindle shape containing four pairs of contact plates, each pair of plates being adapted to clamp opposite ends of a fuse wire, and also clamp the ends of a cord, and form good electrical connections between the cord ends and the fuse wire. In the ends of the case are also diagonal key-shaped slots to receive the loop of the cord and clamp it with sufficient friction to cause it to remain in any position in which it may be placed in the cord adjuster.

ANIMAL SHEARS.—Chester M. Palmer, Lamartine, Wis. This inventor has made an improvement in clippers, having an electro-motor attachment to reciprocate a movable knife in working contact with a fixed and toothed cutter. According to the improvement the cutters proper are connected with a magnet in such way that they are attracted and held in close working contact without the aid of springs or other supplementary devices, the cutters being both oppositely polarized.

Mechanical.

STOP MOTION FOR LOOMS.—Benjamin S. Taylor and Charles Heritage, Hampden, Mass. This is a shuttle box stop motion, arranged to immediately stop the loom in case the shuttle box is not even with the shuttle race at the time the loom starts to pick. Combined with the rising and falling shuttle box and a belt shifter is a notched arm carried by the shuttle box, two pivoted levers and a connection between them and the belt shifter, whereby the belt shifter will be operated to stop the loom whenever the shuttle box is not in proper position relative to the shuttle race. The construction is simple and durable, and the improvement operates very effectively.

APPARATUS FOR TREATING COTTON.—Friedrich Zedler, Cuero, Texas. According to this improvement a number of gins and condensers are located in consecutive order over a flue, the lint cotton in bat form being delivered from all of the condensers in independent bats to a common conveyer, upon which the bat cotton increases in thickness in its travel to a press, compress or other receptacle, receiving the different bats from the different condensers, one bat lying smoothly upon the other, until at the discharge end of the common conveyer, where a bat of evenly distributed lint of considerable thickness is conveniently discharged. The flue in which is the common conveyer, and into which all the conveyers of the condensers lead, has ventilators for the escape of surplus air. This improvement is attached to the steam gin of Messrs. H. Runge & Co., Cuero, Texas, where it has been practically tested for more than a year, giving the best of satisfaction.

KNITTING MACHINE ATTACHMENT.—William Cutts, Tabernacle, N. J. This invention relates to knitting looms or embroidering machines making gauze and similar fabrics, and provides a simple warp frame attachment by which threads may at any time be thrown into the work to make ornamental figures on the fabric. A slotted plate is arranged at the inner end of the warp frame, and in the slots are spring guides adapted to move upward, there being a series of levers beneath the guides by which the latter may be depressed. The attachments are inexpensive, conveniently applied to any ordinary machine, and operated by the customary jacquard to produce the desired figures or patterns.

Mining.

ROCK BREAKER AND ORE GRANULATOR.—Harvey P. Jones, Denver, Col. This is a double-ended machine having grinding bowls or mortars in each end, and simple means for actuating grinding levers and pestles, utilizing all the power by transmission from one end to the other, and giving the pestles a simultaneous reciprocating and oscillating movement, so that they will crush and grind rapidly. The machine is very powerful, and crushes and granulates the rock or ore to any desired degree of fineness. All the wearing parts of the machine are readily removable, so that it may be easily replaced by new parts as the old ones become broken or badly worn.

PLUNGER WORKER FOR CONCENTRATING JIGS.—Otto Abeling, Burke, Idaho. According to this improvement the plunger is moved rapidly down and slowly up in the water, by means of a strong, simple, and adjustable arrangement, not creating any suction on the ore as the plunger rises, but permitting it to drop very rapidly to force the water in the jig up quickly through the ore body, so as to raise the lighter particles of ore. The apparatus has comparatively great capacity and requires but little attention, and the sieve is also kept perfectly clean by the passage of the water through it in a strong upward current.

Agricultural.

HAY RAKE.—George D. Lamm, Ackley, Iowa. This is a side delivery rake, the machine leaving the hay in a continuous straight windrow requiring no dumping. The rake teeth, as they are drawn along, have an intermittent picking movement, to more effectively separate the hay and avoid packing it, whereby it cures more evenly and quickly. All the rake teeth can be raised at one time by a lever within easy reach of the driver, and each tooth is capable of independent movement, lifting automatically in passing over obstructions.

HARROW.—Charles Wehrenberg, Mound City, Ill. This harrow has a toothed revolving drum, with the teeth so arranged and of such peculiar shape at their heads or outer ends that they will cut through the clods, to separate them and pulverise the entire surface over which they pass, and leave it comparatively even. When it is desired to go from one field to another, the movement of a lever causes the toothed drum to be raised out of engagement with the ground.

DRAUGHT EQUALIZER.—Samuel I. Larkins, Murray, Iowa. This is an improvement on a formerly patented invention of the same inventor, simplifying the construction and rendering the equalization of the draught of the cutter bar of a reaper or mower, or whatever load is to be drawn, more positive or decided, the improvement being applicable to any form of machine or vehicle where an equalizer for a four-horse team is desired, in which the draught must be equally divided.

COTTON SEED SEPARATOR.—Thomas A. Jackson, Easton, Ga. For separating imperfect from perfect cotton seed, this inventor has devised a simple and compact machine, which will not crush or break the seed, and which during its operation also removes dust and lint and other impurities. In this machine rotary screens and rotary blast fans having slide motion are dispensed with, but the machine has a fixed screening body with air inlets at its feed end, designed to give a greater air force than has been usual heretofore in rotary screen mechanisms.

SUGAR CANE TRANSFERRING DEVICE.—Alberto Sanchez, Gibara, Cuba. This is a simple and durable construction designed to facilitate the rapid transfer of sugar cane from cars to an endless carrier belt delivering the cane to the mill. It comprises a pivoted platform on which the car to be unloaded is run, a lifting mechanism to lift one end of the platform and dump the cane off the car into an inclined revolubie cylinder in which are longitudinal ribs to straighten the cane, which is thus passed lengthwise upon the carrier belt in proper position to be fed to the crushing rolls.

Miscellaneous.

MANUFACTURE OF PLASTIC ARTICLES.—Konrad Witz, Hoboken, N. J. By a particular construction of the matrix and a special preparation of the mass to be subjected to pressure, this inventor has provided improved means of forming plastic articles between a stamp and a matrix, particularly in pictures or designs of pressed paper board. The cutting of the surface of the paper board by the sharp edges of the matrix is avoided, obviating cracks in the finished article, which is made very strong and durable by one operation of the press, even where the height of the raised portions is quite extreme.

TRIMMER FOR VAULT LIGHTS.—Philip Schwickart, Brooklyn, N. Y. To quickly and conveniently cut or trim the surplus material of the putty, cement, or other substance employed for fastening in position the glass bull's eyes of vault lights, etc., this inventor has devised a novel trimmer. It consists principally of a central post to be supported on the bull's eye, and a cutter frame turning on the post and having cutters which circularly trim off the surplus material at the joint of the bull's eye and the metallic frame.

CANNON PINION FOR WATCHES.—John V. Costa, Delhi, N. Y. This is an improvement in pinions which have spring tongues engaging a groove or shoulder of the center post, whereby the pinion and post are securely held together. According to this invention the cannon pinion has the upper portion of its hub screw-threaded and provided with a spring tongue located between the threaded portion and a pinion proper, while a cylindrical nut screws on the hub and engages the upper end of the tongue at a point below the screw thread.

PHOTOGRAPHIC PLATE HOLDER.—Ernstus B. Barker, New York City. This is a simple and efficient device by which the plate holder may be applied to a camera and the slide withdrawn and replaced without danger of fogging or accidental exposure. A camera back is secured to the rear end of the camera box and provided with a transverse guide, a slide placed in the guide being provided with a ground glass screen, and there being means for holding the plate holder and manipulating the dark slide.

CONVERTIBLE CHAIR.—Clara N. Wonson, Gloucester, Mass., and Dennis W. Palmer, Hermon Center, Me. This is an easy and commodious chair, to be upholstered in the usual way and form an ornamental article of furniture, while it may also be converted into a sick chair, writing desk, bed, table, dressing case, etc., the entire space of the chair being utilized for some practical purpose, and the various portions arranged to conveniently fold together.

DOOR SPRING.—James L. Wilson, Mountain Peak, Texas. This is a cheap and simple device to be applied to a door frame and door to hold the door in open or closed position. A notched lever is pivoted on a notched bracket attached to the door frame, and one end of a spring is held in the bracket notch and its other end in the notch of the lever, while a second lever is pivoted on the outer portion of the bracket, a rod connecting the levers, and the second lever being connected with the door.

WINDOW.—Rudolph J. Mitchell, Jenkintown, Pa. The construction of this window is such that the sashes slide vertically in the ordinary way, while they may also be swung inward to throw open the whole casement and bring the sashes into position to be repaired or facilitate washing the glass. The details are also so arranged that the improvements may be applied to an ordinary window in an old building, as well as to new constructions.

FIRE ALARM.—Elmer A. Wright, Monrovia, Cal. This is an automatic mechanism, with one wire passed through a number of rooms in one direction, then looped and returned, with a fixed guide for the looped end, while a tension device is connected with the ends of the looped wire to keep it normally taut, there being fusible joints in the wire and alarm devices connected with and adapted to be operated by the separation of the wire. The system operates positively to give an alarm in all parts of a building when a fire occurs in any room.

SLEEVE SECTION AND CUFF.—George S. Grier, Milford, Del. This is a combination article with closed tubular section whose middle portion is large and of single ply, but with symmetrical cuff ends of multiple ply and having slits running down into the middle portion, while a circular skirt or flap is stitched exteriorly to the largest part of the middle portion, to fold over and conceal the edge and cover the slit of the cuff end that is not in use.

SEWING MACHINE ATTACHMENT.—Joseph W. Betz, Brooklyn, N. Y. This is a simple and inexpensive felling attachment, so made as to permit the feed block or other feeding device of a sewing machine to have direct contact with the seam flap which is to form the welt, so that if the goods are cut bias, or the seam is curved, as on the inner and outer seams of a garment sleeve, the fullness of the seam flap at its free edge will be properly gathered in as the work progresses, and a neat welt finish will be made.

COOKER.—Moris Finklestein, New York City. This is a simple device particularly adapted to cook milk, or food composed largely of milk, and is arranged in such a way that it may be used in connection with any kind of a fire or source of heat, keeping the milk in circulation so that it will not be burned even though it be cooked for a long time and with an intense heat.

WASHING MACHINE.—Theophilus B. Arndt, Florin, Pa. This machine has a clothes holder whose bed consists of a series of radiating ribs, alternate upright slats fitting at their lower ends snugly between the ribs, providing an improved rubbing surface and novel means for securing the bed or clothes receiver in the suds box. A simple construction of handle renders it easy to operate the machine by persons of different heights.

WIRE AND SLAT FENCE MACHINE.—Andrew W. Lane, Fredonia, Kansas. According to this invention, slide bars carrying oppositely arranged racks engage gear wheels formed with transverse openings for the wires, whereby the pickets or slats may be quickly and securely woven in place in the sets of wires. A picket is inserted in the sets of wires at the end of each up or down stroke of the rack bars, so that the twists on opposite sides of a picket are in opposite directions. The machine is of strong and simple construction, and designed to be very efficient in operation.

VEHICLE DASHBOARD AND FENDER.—Alma F. Blease, Hammond, Ind. This improvement comprises a metallic frame made in two sections and formed with hooks on their opposite faces, the hooks being adapted to engage one another, and a sheet of leather, fabric, or other material interposed between the frame sections and formed with slots for the passage of the hooks, whereby a strong and durable dashboard or fender is produced, and which can be readily applied to the vehicle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ELECTRICAL MEASUREMENTS FOR AMATEURS. By Edward Trevert. Lynn, Mass.: Bubier Publishing Company. 1894. Pp. 117. Illustrated. Price $1. No index.

Four chapters are contained in this book, one on Electrical Units, one on the Measurements of Resistance, one on Current Measurements, and finally, one on Potential Measurements. In the beginning of the second chapter the author speaks of "taking the volts and amperes of a current." This is, unfortunately, perpetuating, to a certain extent, the formerly frequent error of attributing voltage to a current, and in the same sentence he refers to "a number of special instruments which are modifications of one or more of the above methods." As almost any work on this subject must be useful to a greater or less extent, we can at least say that Mr. Trevert's book will be of some value, but the examples of inaccuracy of expression given from a single sentence certainly go to indicate the need of careful revision to bring the work up to the proper standard. A four-line contents is given, and no index is contained in the book.

MINING: AN ELEMENTARY TREATISE ON THE GETTING OF MINERALS. By Arnold Lupton. London and New York: Longmans, Green & Co. 1893. Pp. xxiv, 519. Price $3.

The somewhat egotistical preface discloses what seem to be admirable qualifications for the writer of such a book. It is a thoroughly practical treatise, illustrated and indexed, and what is more to the purpose, is not dedicated to any of the deadly syllabus of the English examination system, and for the actual mining engineer we believe it is strongly to be recommended.

COLUMBIAN KNOWLEDGE SERIES. No. 1. Total Eclipses of the Sun. By Mabel Loomis Todd. Boston: Roberts Brothers. 1894. Pp. xv, 244. Illustrated. Price $1.

The preface states that the volume now being reviewed is written "neither for astronomers, nor for eclipse experts, but to give very unprofessional information to those without technical knowledge." A very pleasantly written prefatory note discloses this much, and while it discloses much that is really in the book, it reveals also its very popular and attractive style. It is very beautifully illustrated and is strongly to be recommended. It has an excellent index and contains very interesting biographical matter, including portraits of several distinguished astronomers.

HOW TO MAKE AND USE THE TELEPHONE. By George H. Cary. A treatise for amateurs, with working drawings. Lynn, Mass.: Bubier Publishing Company. 1894. Pp. 117. Price $1.

The title of this book describes what it is. It is entirely practical and written for the amateur and unprofessional user of telephones. It has both contents and index, and contains some useful wire tables.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

For mining engines. J. S. Mundy, Newark, N. J.

"U. S." metal polish. Indianapolis. Samples free.

Stave machinery. Trevor Mfg. Co., Lockport, N. Y.

Edmonds' Automatic Oil Burner, Bradford, Pa. Circulars free.

Fruit stoner patent for sale. See illus. notice page 357. Joseph Boeri, 626 5th Avenue, N. Y., basement.

Bookbinding.—All classes of work. Magazines a specialty. Haddon & Co., 130 Center St., New York.

Microbe Killer Water Filter, McConnell Filter Co., Buffalo, N. Y.

Distance Reading Thermometers.—See illus. advertisement, page 319. Ward & Doron, Rochester, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. B. Dudgeon, 24 Columbia St., New York.

Cheapest Water Power.—See top of 1st column, page 175. Also top of 2d column, page 239. Look, it will pay.

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Centrifugal Pumps. Capacity, 100 to 40,000 gals. per minute. All sizes in stock. Irvin Van Wie, Syracuse, N. Y.

Inventors wishing to bring their inventions to the public notice should confer with H. Pittock, Room 61, 1 Beacon St., Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

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Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

Patent for Sale.—Newly patented machine for cutting toothpicks, match sticks, kindling wood, etc., from veneer. Nine millions per hour. J. Powers, 45 Varet St., Brooklyn, E. D., N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6063) M. L. R. asks: 1. Should it be made a point, when putting wire in a house for a telephone, to keep it away from the roof? How near may it come without danger? A. No special care need be taken. A foot or two is ample distance. 2. Please explain the phenomenon caused by striking sugar with a piece of metal, when a flash of bluish light may be seen. A. It is phosphorescence due to mechanical and electrical disturbance of the molecules.

(6064) W. G. M. asks: 1. Can I connect a small sewing machine motor on to electric wire in place of an incandescent lamp? A. Not unless wound for the potential of the circuit. 2. Will the telephone spoken of in query No. 5985 of April 28, 1894, operate successfully in a city among electric wires, and for how long a distance could it be used? A. It will work fairly well up to a distance of several miles. 3. Two palm leaf fans connected to an arm five feet long, suspended from the ceiling, make a three foot stroke and thirty strokes each way per minute. How heavy a weight attached to clockwork, and falling eight feet, will be required to operate the fan continuously for eight hours? A. It would require several tons weight.

(6065) A. F. W. writes: 1. I have removed the copper plating from electric light carbons by placing them in the fire for three-quarters or a half an hour. I have then used them for a bichromate battery. A. We are glad to give our readers this suggestion. 2. In a Brush lamp are there two arcs or one? A. One arc. 3. How often do the carbons have to be renewed? A. Every day. 4. Do you know of any book that tells fully how to do sleight of hand tricks? A. We can supply the following books: "Sleight of Hand," by Sachs, London, price $3; "Modern Magic," by Professor Hoffman, price $2.50; "Art of Modern Conjuring," price $1.50, mailed.

(6066) G. L. C. asks: How much will it take of ammonia at 28° Baume to neutralize 1 ounce of tartaric acid (crystal). A. For 1 part tartaric acid 0·69 of ammonia solution is needed, all parts by weight.

(6067) C. B. S. asks: 1. What kind of wood would be best to burn for potash manure? A. Elm and vine. 2. Would the ashes from pine wood sawdust be good? A. They are very poor. 3. How is sulphate of potash made? A. By neutralizing the carbonate with sulphuric acid, evaporating and crystallizing. 4. Will you name a good book on the above subject? A. We can supply "Chemistry of Acids, Alkalies, and Salts," by Richardson & Watts, 3 large volumes, price $20. Also Wagner's "Chemical Technology," price $7.50.

(6068) F. A. asks: I have dynamo No. 600. The armature is wound with No. 18 B. & S. wire. Can I wind fields to generate a current to light six or eight 16 candle power 110 volt lamps, and if so, how much of what size wire? A. The armature will need rewinding, as well as the field, for change of voltage. No. 18 wire is too large.

(6069) F. R. B. asks: Would an incandescent lamp that requires ½ ampere of current on a 110 volt circuit have 220 ohms of resistance? If so, would the candle power be about 16? A. Yes.

(6070) J. O. L. asks: Will you inform me how to make copper wire flexible? A. If you mean to make copper wire springy, it can be done by drawing from a larger size and not annealing.

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May 29, 1894,

AND EACH BEARING THAT DATE.

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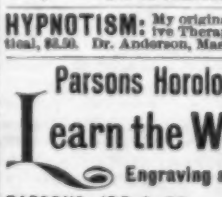

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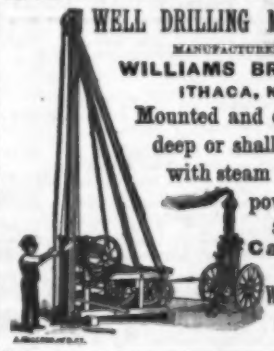

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